INTERFACE AGE™

MICROCOMPUTING FOR SMALL BUSINESS AND HOME
VOLUME 3, ISSUE 1 JANUARY 1978 $1.75
CANADA/MEXICO $2.00 INTERNATIONAL $3.00

Floppy ROM #3
The Word Processor

QWERTY Is Obsolete

Tax Calculation Programs
Medical Receivables Package
Report Writing By Microcomputer

6800/2 IS HERE

The 6800/2 uses our new A2 processor board with socket space for 8K bytes of ROM/PROM. This makes it possible to use the 6800 in applications where ROM programs are useful without purchasing an expensive PROM accessory board. The A2 board has a DIP switch selector that allows you to replace any 8K block of memory above the RAM memory that extends to 32K with memory external to the processor board itself. This lets you develop special programs that will later be put in PROM in a normal RAM memory card where it can be modified and debugged. The A2 board has a crystal controlled baud rate oscillator and a separate clock driver oscillator whose frequency may be changed with a programming resistor. The A2 processor board gives you the maximum possible flexibility in setting up a computer system.

SWTBUG® Monitor—

The 6800/2 is supplied with our new SWTBUG® monitor. This new monitor is software compatible with the earlier Mikbug® monitor used in the 6800. All major subroutine entry points are identical. SWTBUG® features a resident MF-68 Minifloppy disk boot, single level breakpoints, vectored software interrupt, generation of punch end of tape formatting and automatic interface configuring for either the MP-C control interface or MP-S serial interface.

ACIA Type Interface—

The 6800/2 uses our MP-S serial interface. This RS-232 and 20 Ma. TTY compatible interface may be configured to operate serially at the following baud rates: 110, 150, 300, 600, 1200, 2400, 4800 and 9600. Complete interrupt control is available through the user's software.

4K Static MEMORY—

The 6800/2 comes wth 4K of static RAM memory on our MP-8M board. The memory may be expanded to 8K by the addition of eight more memory chips. No additional parts are needed. Full buffering of all data, address and control lines is a standard feature. Memory expansion to 32K of continuous RAM memory and up to a 48K mixture of ROM/RAM is possible with this system.

ACCESSORY BOARDS—

Do you have a special job? Our accessory boards make it possible to use the 6800/2 for almost any type of computer application. We have our MP-T interrupt timer with software interrupt selectable output. Our MP-N calculator interface that allows you to do arithmetic functions in hardware. Our MP-R EPROM programmer that programs and verifies EPROMs right in the machine—and more coming.

6800/2 Kit. . . . . **$439.00 ppd Cont. U.S.**
6800/2 Assembled. . . . . **$495.00 ppd Cont. U.S.**

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SWTPC

SOUTHWEST TECHNICAL PRODUCTS CORPORATION
219 W. RHAPSODY
SAN ANTONIO, TEXAS 78216

CIRCLE INQUIRY NO. 52

You can now have the industry's finest microcomputer with that all-important disk drive

The professional-grade microcomputer for professionals

Shown with optional bench cabinet

YOU CAN GET THAT ALL-IMPORTANT SOFTWARE, TOO

Loading your programs and files will take you only a few seconds with the new Cromemco Z-2D computer.

You can load fast because the Z-2D comes equipped with a 5″ floppy disk drive and controller. Each diskette will store up to 92 kilobytes.

Diskettes will also store your programs inexpensively—much more so than with ROMs. And ever so much more conveniently than with cassettes or paper tape.

The Z-2D itself is our fast, rugged, professional-grade Z-2 computer equipped with disk drive and controller. You can get the Z-2D with either single or dual drives (dual shown in photo).

CROMEMCO HAS THE SOFTWARE

You can rely on this: Cromemco is committed to supplying quality software support.

For example, here's what's now available for our Z-2D users:

CROMEMCO FORTRAN IV COMPILER: a well-developed and powerful FORTRAN that's ideal for scientific use. Produces optimized, relocatable Z-80 object code.

CROMEMCO 16K DISK BASIC: a powerful pre-compiling interpreter with 14-digit precision and powerful I/O handling capabilities. Particularly suited to business applications.

CROMEMCO Z-80 ASSEMBLER: a macro-assembler that produces relocatable object code. Uses standard Z-80 mnemonics.

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The new Z-2D is a professional system that gives you professional performance.

In the Z-2D you get our well-known 4-MHz CPU card, the proven Z-2 chassis with 21-slot motherboard and 30-amp power supply that can handle 21 cards and dual floppy drives with ease.

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- An RS-232 serial interface for interfacing your CRT terminal or teletype
- LSI disk controller circuitry

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Your Z-2 was designed with the future in mind. It can be easily retrofitted with everything needed to convert to a Z-2D. Only $935 kit; or $1135 for assembled retrofit package.

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Additional disk drive (Model Z2D-FDD) . . . . . $495.

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(On standard IBM-format soft-sectored mini diskettes)

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FORTRAN IV (Model FDF-S) $95
Z-80 Assembler (Model FDA-S) $95

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CIRCLE INQUIRY NO. 11

VOL. 3, ISSUE 1 JANUARY 1978

SINCE DECEMBER 1975

COVER STORY

Our cover of the May 1977 issue portrayed the beauty hidden with the *skull* of the electronic brain. This month our cover displays the esthetic quality inherent in good design. The "Writehander™" was designed from the technological core outward. The visible element is a product of another discipline, human engineering. The natural articulation of the primate hand determined the hemispheric shape. Color and texture of the material chosen determined the artistic element.

In the background an ASCII encoded QWERTY keyboard is shown in ghostly form to symbolize the former design's honorable service, now overshadowed by the new generation.

INTERFACE AGE™

MICROCOMPUTING FOR SMALL BUSINESS AND HOME

FEATURES

HARDWARE FEATURES

SOFTWARE FEATURES

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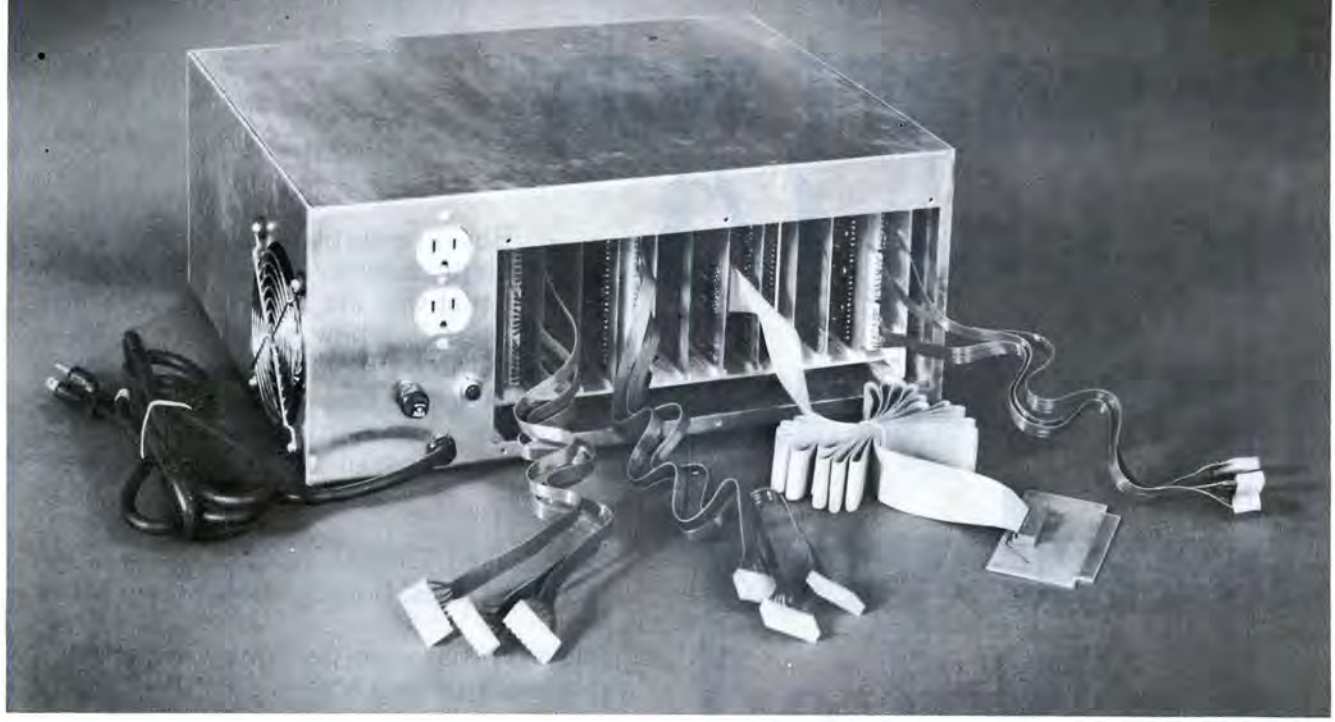
Welcome to the Real World



with the Real-World Interface from The Digital Group

A computer should have a purpose. Or as many purposes as you can imagine. Because a computer belongs in the real world.

And now, the Digital Group introduces the Real-World Interface. A system component that's actually a system in itself, and specifically designed to help you get your computer to control all those tasks you know a computer can control so well.

Automate your sprinkler system. Heat and cool your home. Guard against burglars. Shut off lights . . . It's all a part of the Real World, easily controlled with the Digital Group Real-World Interface.

Our Real-World Interface is initially made up of three basic components — motherboard and power supply, parallel CPU interface and cabinet — plus three types of plug-ins: AC controller, DC controller and prototyping card. The recommended software packages are Convers, Assembler or Maxi-Basic, in that order.

Some of the features include:

Motherboard & Power Supply
- 12 slots — 11 control cards, one for the interface card
- +5V DC±5% @ 1A, +12V DC ±5% @ 1A, -12V DC ±5% @ 1A contained on board
- May be free-standing (with care)

Parallel CPU Interface
- All buffering for Data Out (25 TTL loads), Address (25 TTL loads) and Data In (10 TTL loads)
- Includes cable and paddlecard for connection to dual 22 on Digital Group CPU back panel. Two 22-pin edge connectors included
- Requires two output ports and one input port

AC Controller
- Eight output devices (2N6342A-2N6343A, -12 amp Triacs); Each output 240V AC max, 12A max RMS
- Control AC motors, lamps, switches, etc.
- Opto-isolated (MCS-2400 or equivalent)

DC Controller
- Eight output devices (2N6055) each output up to 50V and up to 5A
- Control DC motors, switches, solenoids, etc.
- May use internal +12V DC for load or external DC up to 50V DC

Price
- For the motherboard and power supply, parallel CPU interface and cabinet, our kit price is only $199.50, or $260 assembled. Now *that*'s down to earth.

We've only just begun our Real-World Interface System. There are many more plug-ins and applications coming along soon. So write or call The Digital Group now for complete details.

And welcome to our world.

the digital group INC

P.O. BOX 6528 DENVER, CO 80206 (303) 777-7133

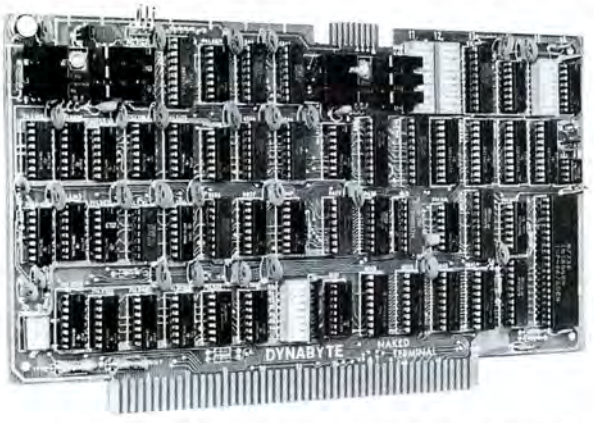
Buy a dumb terminal the smart way and save 1/3. Introducing Dynabyte's new Naked Terminal:

Buying a dumb terminal used to get pretty expensive - about $1,000. But that was the old, dumb way. Now there is a new, smart way to add a dumb terminal to your system. Get Dynabyte's new Naked Terminal and add a keyboard and video monitor at a cost of about $650. You save around $350!

The Naked Terminal does all that a dumb terminal does. Some things it does better.

It displays 80 characters per line by 24 lines. And it displays it on any screen size: 9, 12, 15 or whatever size you prefer. The $1,000 one doesn't give you a choice. Both upper and lower case characters are displayed in a 5 x 7 font.

Although you spend less money you get more features: half duplex, full duplex, and a block mode that allows editing before transmission. You-know-who doesn't have a block mode.



The Naked Terminal has addressable cursor. And its display offers you lots of switch-selectable flexibility: black-on-white or white-on-black, blinking or non-blinking underline cursor, and variable baud rates.

No software support is required. The Naked Terminal can be configured by dip switch to drop into an existing system, replacing the serial I/O card and stand-alone terminal without making any changes to software.

The Naked Terminal is a complete dumb terminal on an S-100 board. It contains a microprocessor with its own memory, its own software drivers, and its own internal bus. We built it that way so it won't take up any of the 64k memory address space of the S-100 bus. Keyboard and video monitor cables are available at additional cost.

Like all Dynabyte products, the Naked Terminal is completely assembled, socketed, tested and burned in. Dynabyte's guarantee is for a full year - the longest in the industry.

Now isn't the Naked Terminal a smart buy? Learn more about saving 1/3 on a dumb terminal. Ask your local computer retailer. Or write today to Dynabyte, Inc., 4020 Fabian, Palo Alto, CA 94303. Telephone (415)494-7817.

DYNABYTE

CIRCLE INQUIRY NO. 103

Now Dynabyte builds three Great Memories

New! 16k and 32k fully static RAM's. With either 250 ns. or 450 ns. typical access time. Assembled. Tested. Burned in. Guaranteed. Like our 16k dynamic RAM. Built as solid as the 4,400 year-old pyramids.

Ancient Egyptians didn't stop with just one pyramid. The Great Pyramid stands on the Plain of Gizeh with two other monuments erected for kings and queens.

Dynabyte didn't stop with one 16k dynamic RAM, either. Now you can get 16k and 32k fully static RAM's that are built with the same unmatched engineering ability and manufacturing skill that went into Egypt's wonders of the ancient world.

When we say built, we mean completely built. Assembled, tested and burned in. We don't leave anything undone. That way, you can buy any Dynabyte memory and know that it is backed by a factory guarantee for one full year. Kits and semi-kits can't say that.

Our 16k static and our 32k static are available with either 250 ns. or 450 ns. access time. Our 250 ns. module is completely compatible with the 4MHz Z-80A processors. The 450 ns. modules are compatible with the 8080 and the faster 3MHz 8085 processors.

The Great 16k Static Memory. 250 ns., $555. 450 ns., $525.

- 4k block addressing along 4k boundaries
- Bank Select
- Write Protect with alarm for each 4k block
- Full Schmitt trigger buffering
- No DMA restrictions
- Complete S-100 bus compatibility, including the Alpha Micro and Z-2.

The Great 32K Static Memory. 250 ns., $995. 450 ns., $925.

- 4k boundary addressing
- Full Schmitt trigger buffering
- No DMA restrictions
- Conservative thermal design
- Complete S-100 compatibility, including the Alpha Micro and Z-2.

The Great 16k Dynamic Memory. $399.

- Highly cost effective
- No wait states
- Transparent refresh
- 16k addressing boundaries
- Widest S-100 mainframe and disk system compatibility

All of Dynabyte's memories meet rigid industrial grade standards. Design, components, construction, testing and performance. But if a module ever needs repair, we provide factory service with 24 hour turnaround for both warranty and non-warranty work.

Ask for the Great Memories by Dynabyte at your local computer store. You can also pick up complete product information while you're there.

But if you haven't got a local computer store, write Dynabyte, Inc., 4020 Fabian, Palo Alto, CA 94303. Or telephone (415) 494-7817.

Why Dynabyte doesn't build memory kits

Assembling a kit can be fun; almost anyone can do it.

But how about testing it? Do you have the test programs and equipment? Do you know which memory test program uncovers pattern sensitivity? Or which finds shorted data bits but won't find address decoder faults?

We do. It's our business. We have the 200 MHz oscilloscopes, the logic analyzers, the burn-in chambers, and the test programs. We find the bugs, even the subtle ones.

Which lets you concentrate on computing.

DYNABYTE

Builders of Great Memories

INTERFACIAL

"QWERTY IS OBSOLETE" is not a call to arms against the Flag and the Constitution, but it may be a *manifesto* against a hallowed tradition of technology, the keyboard that has held our ten fingers in thralldom for so many years. Sid Owen is a man who looked at this ubiquitous design and asked himself, "Do you really need ten fingers?" He then set about to prove that half that number will do. Sid Owen stands out, not for having a successful new product, rather for having dreamed that he could make a change in his world.

Last May Bob Jones, our publisher, and William Turner who has since become our Southeastern Regional Editor, made a change in our world of publishing computer information when they launched THE FLOPPY ROM™ EXPERIMENT, a plastic platter bound into the magazine engraved with a 4K BASIC interpreter program. The experiment was repeated in the September issue with the platter containing Bud Shamburger's GENERAL LEDGER PACKAGE. This third event can no longer be called an experiment, rather a viable publishing practice. The FLOPPY ROM™ contains the software of WORD PROCESSOR PROGRAM by Ken Knecht. This is the third in a projected series of useful material planned by INTERFACE AGE in the next years.

Good software, however, without good hardware is as limited as a Shakespearean actor with permanent laryngitis. Carl Denver Warren II authors a descriptive article on a high-speed cassette system called the MECAdrive and Roger Edelson shows you how to tell time with your computer in his CARD OF THE MONTH feature, CL 24 REAL TIME CLOCK. Three engineers from National Semiconductor Corporation pooled their talents to author THE GLASS TELETYPE, a device which enables the microcomputer user to use a television set or video monitor as an output device. This inexpensive system coupled with a readily available switch matrix or encoded keyboard for input, provides a complete terminal far below standard peripheral cost.

Also of value to the homebrew user with limited funds is a hardware clock. Darrel van Buer describes his INTERVAL TIMER DESIGN.

Our book selections this month also are of interest to the hardware builder. In this issue's reviews you will see how Capt. Judith Scolney (Robertson), U.S.A.F. (Ret.) did not win her commission entirely by being harmless. In the course of last year we have been silent about our book reviewers, Larry and Judy. At regular intervals we hand them stacks of books, catalogs and diverse printed matter and expect them to spend their spare time reading and evaluating this output from the printing presses, then at our press deadlines we dun them for manuscripts. In this first issue of 1978, we want to take the opportunity in the name of our readers to say "thanks" and wish this brilliant couple and their gifted daughter a fulfilling year.

Along with our standing lineup of columnists, a new name appears, James S. White. Jim will inform you on developments in microcomputing for small businesses.

Putting out a broad-spectrum computer magazine is like pulling a dogsled with a fan hitch. The editors come from various walks of life, portray diverse viewpoints and each applies traction at his own slant. When Ashok Nagrani's article COMPUTERIZED SPEECH WRITER arrived here, its content elicited chuckles from some of the staff and less than favorable comments from others. My vote for acceptance won out by a slim margin and I planted the article into Abe Perez' section. I did it and am glad — and many of you will probably chuckle with me. Others of you may be tempted to pen irate letters accusing the author and the magazine of making a mockery of report writing. So be it; this aspect should be told, and if it hits a sore nerve, first wonder why the spot is so raw, then if you are still angry, do us the favor to aim the darts at me. I am responsible.

—Linda Folkard-Stengel

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CIRCLE INQUIRY NO. 40

LETTERS TO THE EDITOR

ASTRONOMY SPECIAL

Dear Editor:

Your Astronomy/Astrophysics issue has set another new high. It recalled to mind a mixture of space and computer technology which first occurred to me some years ago. What if — we build a spaceship containing a self-maintaining supercomputer and launched this vessel on a path through space-time such that the vessel would experience a time expansion of 11:1 (say 10000:1). It would return to Earth after the passage of only 5 years' earth time but would itself be 50,000 years older (and wiser). The machine would be equipped with a great knowledge base and would be assigned the task of finding the cure for aging, the Holy Grail, etc. I suspect that a trajectory through space time with the required attributes could be found, but I am not sure how to do it.

It may not be possible for many years to build a ship capable of attaining the required velocity and energy level. Since the vessel would be unmanned, it does not need to be a physical spaceship. Our computers in a sense are not physical devices but rather highly complex, rapidly changing, and self-modifying fields of electromagnetic energy. Can we separate the field from the physical computer in order to transmit intact field through space? The semiconductors (FETs) and wires of today's computers serve to contain and guide the field. Can the containment function be performed by the field itself, can an electromagnetic wave emulate a semiconductor as well as a wire? Such a computer would be a true electronic device! It might in fact be an "electronic consciousness vehicle" such as can be found in the literature of mysticism, assuming computers can be "conscious."

A near term application which I have in mind for my 8080 system is to use it as a lie detector. A company in Springfield, Virginia is marketing a device for psychological stress evaluation based on the principle that "micro tremors" in the human voice are suppressed when a person is under stress such as that associated with fear of being caught lying. These micro tremors are a frequency modulation of the voice signal at 8 to 14 Hz. The voice signal would be digitized using an A-D converter or Speechlab type device. I know how to detect FM when the modulated signal is a simple sine wave using either common radio circuits or a Fourier Analysis program but when the signal being modulated is complex such as a voice, I run into problems. Could any of your readers suggest a program, algorithm or circuit capable of separating these two signals, the voice and the micro-tremor FM?

P.S. I think a truth detector program would make a super software article. If you agree, I'd be glad to send you copies of the literature which I have on the subject.

James R. Tyron
5340 Holmes Run Pkwy., #1504
Alexandria, VA 22304

Thanks for the compliment on the August Issue. Your work on lie detecting sounds as if it would make good reading. Send it in and share your ideas with other readers.

—Editor

Dear Editor:

The program on "Computing the Positions and Orbits of the Planets" was truly most interesting. However, I found a drawback. People using a SWTPC 6800 and Robert Uiterwyk's 8K BASIC will have a long time to wait for results from lines 400 up to 485. I myself found that it took almost 32 minutes to get the number of degrees for Venus. Being a 6800 owner with the 8K BASIC I knew there had to be a way of speeding up the process with as little error as possible. I found out how and now it takes only a few minutes and the error in my opinion is acceptable.

Below is the patch for line 430 to speed up the mathematical process.

```
430 X=X+0.017453925 - 8.726646245E-03
```

Using the above formula introduces a slight error. My findings were from 0.05 degrees up to a maximum of 0.36 degrees. If the user can tolerate such an error the person will find that the process is speeded up by about 20 minutes in most cases. The formula has been tried for most of the planets on the chart at various dates. I hope readers will find it useful and would be interested if someone has even a faster way with less error. Anyway it is a starting point.

Dennis W. Tracy
151 Gemini Avenue
Winnipeg, Manitoba
Canada R2G 0T7

Dear Editor:

I read, with interest, Ed Keith's article entitled "A Better 6800 Memory Test — Memtest" in the July 1977 issue of INTERFACE AGE. Mr. Keith has done an admirable job in programming a solution to his problem — namely a more complete memory test than that produced by Robit-1. However, it seems to me that there is one tiny flaw in Mr. Keith's approach. Since every 100th position of memory is loaded with the same data during Phase 1 of Memtest, Phase 2 would be unable to detect a short that occurred between two memory positions 100 addresses apart.

Such a situation as described in the previous paragraph could, theoretically at least, occur. If one or several such shorts happened, the shorted memory positions would respond to more than one address, but Memtest would be unable to detect it because it would load like data into these locations. Despite the short, no alteration in the expected pattern would occur.

If a memory had all of its locations wired (or shorted) to all other locations that were a multiple of 100 addresses away from it, it would certainly be unusable. However, a tool other than Memtest would be required to diagnose the problem correctly.

Kenneth C. Service
Exton, PA

Dear Editor:

While I feel that the article "The Remotoid/Android Project" by Roger Garrett, in April 1977 INTERFACE AGE, was adequate in most respects, there are a couple of points I would like to make.

First, the principal components of muscle tissue, actin and myosin, have been known for quite a few years; they aggregate when mixed to

form fibers of actinomyosin, which contract upon exposure to ATP, which acts as an energy source. As far as I am aware, this system has never been put to any practical use (i.e. locomotion) by any other than living organisms.

The other dubious aspect of this article is the idea of using a plutonium PN junction sandwich for a power cell. There are several obvious defects to this approach. 1) Plutonium emits not only gamma radiation, but also neutrons due to spontaneous fission. 2) The combination of plutonium and the so-called "inert material" — obviously intended to be a plastic, from the drawing — serve to turn S.F. neutrons into thermal neutrons within the package. 3) The silicon itself can be transmitted into phosphorus; this affect is the basis for the so-called "neutron doping" in semiconductor silicon. 4) If the P-type dopant is boron, which has a thermal neutron capture cross-section orders of magnitude larger than almost anything in the package except plutonium, it will serve as a neutron "sink." 5) Care should be taken to avoid assembling a "critical mass" of plutonium; this is made difficult because (a) thermal neutrons are not retained within the package, and (b) a high density of these units would seem to be required for adequate power generation. 6) Even in the event that a plastic package is not used, this probably means a glass-ceramic package, which might entail high temperature sealing; care should be taken to avoid too high a heat, for plutonium has seven crystalline allotropes — each with a different density. This effect alone might cause intolerable stress within the package. (Obviously the engineering problems are substantial either way you go — which is not to say that it couldn't be done, but just not in so simple a manner.)

I suppose the point I'm trying to make is that when someone writes an S.F. piece for your magazine, he should check his science a little, or even collaborate on points he's not sure of, because even though a majority of your readers (myself included) know just a *little* about computers, it is invalid to assume that, because of that, we are also scientific illiterates.

Keep up the good work!

Glen Lewis
Garland, Texas

We have received feedback from a great number of people on this article. Each reader who called or wrote had a very personal and unique response to it. Not all were favorable, some calls were even abusive, but most described themselves as hav-

ing been "entertained" or even "inspired." —Editor

Dear Editor:

I have received my first copy of INTERFACE AGE Magazine. I just become interested in computers about a year ago. You have some very interesting articles including "A Byte of Music" by Christopher Smith. My first computer project was the Cosmac RCA 1802. The "Byte of Music" was a very well thought-out article. Keep the articles concerning the RCA 1802 going, especially the programs. Is there any source where you can obtain these programs for the 1802?

Andy Brewer
4917 Monte Vista Dr.
Knoxville, TN 37914

We are publishing Mr. Brewer's complete address to facilitate his search for information. —Editor

Dear Editor:

I was pleased to see a programmable calculator program even though it is not one I have use for. If you have any others in back issues I'd by happy to receive them. Especially any for Texas Instruments SR52 and TI59. Such in the future will also interest me.

Regarding computers, I'm a bystander, waiting, watching. My one-man business doesn't have $8K for an adequate computer now, but, like calculators' prices, may improve in time. Your magazine looks pretty good. I'll read, learn and keep posted. I like your cover story.

Tom Swalenberg
Columbus, OH

We plan to run one PPC story per issue as soon as article contributions make it feasible. —Editor

BYTE OF MUSIC

Dear Editor:

I read Christopher Smith's article in the November issue of INTERFACE AGE Magazine and was impressed by the use of the computer as a transcriber of music. I have heard the RF energy picked up by a portable radio placed on top of a large business computer but he has actually tuned the computer to perform a melody . . .

I am planning to buy a microcomputer for my son this Christmas. After looking at many of the systems available, the RCA COSMAC VIP kit seems to be the best buy for the hardware received. On top of that he'll get twenty games already programmed for him to start to use it.

My only reservation is what else can the COSMAC system provide after the novelty of the games has worn off. Programming in actual machine language is a tedious task and may discourage him from using it. I'm assuming that you have investigated the sources of software for the 1802. Do you know of anyone who has or is planning to write a BASIC for the 1802? Are you familiar with clubs that have been formed to

Computer Mainframe System

First in the TEI family . . . The MCS-112 and 122 Mainframe Systems.

"The Base on Which to Build"

The cabinet
A heavy duty, precision formed cabinet of fine craftsmanship. Completely machined and ready for assembly. The exterior is finished in TEI blue. Vented for most efficient thermal characteristics. Furnished with all necessary hardware.

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An S-100 Bus system high quality mother board with 100-pin edge connectors. Compatible with IMSAI, MITS, CROMEMCO, TDL and other S-100 bus configured circuit boards. Plug connections for reset switch. Voltage terminals are screw type to power supply leads. All card guides are provided. 12 slots for MCS-112 model and 22 slots for MCS-122 model.

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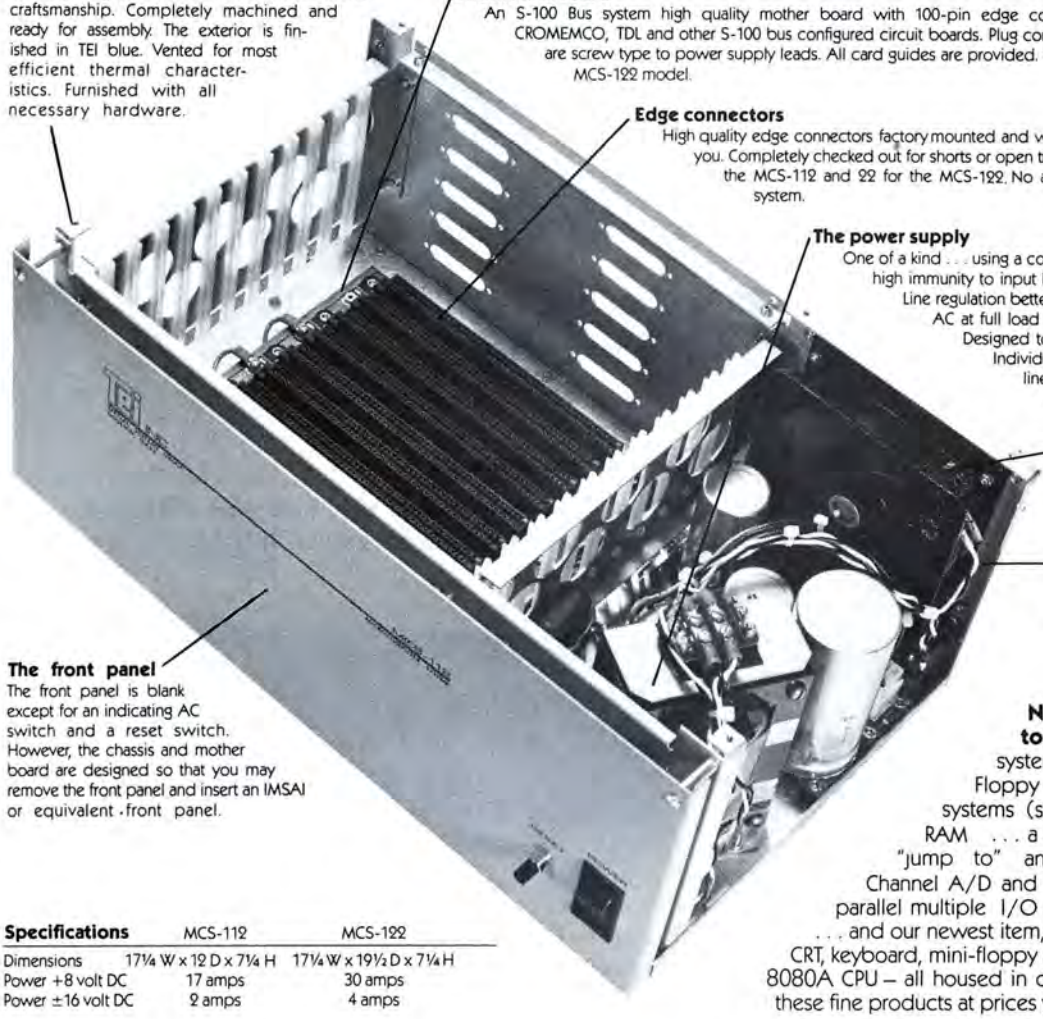
High quality edge connectors factory mounted and wave soldered to eliminate this nuisance for you. Completely checked out for shorts or open traces. ALL edge connectors furnished, 12 for the MCS-112 and 22 for the MCS-122. No additional expense when you expand your system.

The power supply
One of a kind . . . using a constant voltage transformer (CVT) with a very high immunity to input line noise . . . greater than 100 db rejection. Line regulation better than ± 1% from an input of 95 to 140 Volt AC at full load to 85 to 140 Volt AC at three quarter load. Designed to meet UL-478 specifications (EDP SPECS). Individual fusing on all input and output voltage lines. See specifications below for power ratings.

The cooling system
A 115 CFM muffin fan with a commercial grade washable filter will provide clean airflow over all circuitry.

The wiring
All wiring is color coded and ALL is precut to length with connecting lugs factory machine applied.

The front panel
The front panel is blank except for an indicating AC switch and a reset switch. However, the chassis and mother board are designed so that you may remove the front panel and insert an IMSAI or equivalent front panel.



Specifications	MCS-112	MCS-122
Dimensions	17¼ W x 12 D x 7¼ H	17¼ W x 19½ D x 7¼ H
Power +8 volt DC	17 amps	30 amps
Power ±16 volt DC	2 amps	4 amps

NOW . . . TEI puts it all together for you. Mainframe systems (12 and 22-slot) . . . Floppy and mini-floppy disc drive systems (single, double and triple) 16K RAM . . . a Z-80 CPU with addressable "jump to" and autostart capability . . . 16 Channel A/D and D/A converter . . . 3 serial + 3 parallel multiple I/O . . . and other supporting boards . . . and our newest item, the PROCESSOR TERMINAL — A CRT, keyboard, mini-floppy disc and 12-slot mainframe with a 8080A CPU – all housed in one quality aluminum case. All of these fine products at prices you will like. **Watch for them all.**

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That's right. $585. That gets you two Phi-Decks, controller card kit and power supply. Which means you get more bytes per buck. Take a look.

The features:

- Controller card supporting mutiple drives
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  254,000 8-bit bytes on C-30 cassettes
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What our system allows you:

- Indexed software controlled program file
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- Duplication and backup of important data
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- System residence

What our software operating system offers:

- 8080-based design
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- Block size from 1 to 256 bytes
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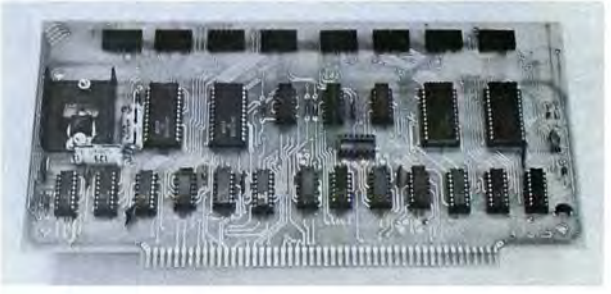
How to get connected:

With Peripheral Vision's new four-port I/O board. It's another one of our bargains. Only $85. To save you bucks.



We've only given you a glimpse of our exciting new cassette storage system and the four-port I/O board. For more details, just fill in the coupon below. For cheap little bytes.

PERIPHERAL VISION INC.

P.O. Box 6267/Denver, Colorado 80206 303/777-4292

O.K., I'll byte! Send me details on your cheaper way to store data and get it connected!

Name_____

Address_____

City/State/Zip_____

expand the hardware and software capabilities of the 1802 system?

My original idea was to build an 8080 kit and expand the memory, interfaces and I/O as time and funds permitted, but it seems that when all is considered the 8080 system will cost much more than an equivalent 1801 package. Will you please tell me why he decided on the RCA 1802 and what advantages he sees it has over the 8080a or the Z80 system?

Richard Nicewicz
W. Babylon, NY

The letter was addressed to Mr. Smith. We sent him a copy for personal reply and re-edited the test into the third person when Mr. Smith's reply did not arrive in time for press date. —*Editor*

SOLUTION TO THE NOVEMBER COVER

Dear Editor:

The letter (November issue, pg. 45) is an 'R.' An integrated overview is shown in Figure 1 below, with numbering to correspond with that of Figure 4 in November. Note that from the viewpoint v shown, the letter just might be a weird 'K,' as shown in Figure 2. However, one other viewpoint v', as labeled in Figure 1, is sufficient to distinguish between 'R' and 'K.'

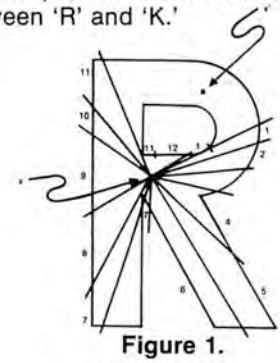


Figure 1.

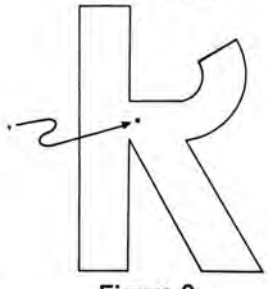


Figure 2.

P.S. The "clue" on the cover of November is, of course, that the bald point-human is in an 'R.' Incidentally, the word "RAM" was chosen for the cover because (1) it begins with an

'R' (a letter which has both straight and curved portions, plus a "hole"), (2) "RAM" has significance as a computer acronym, and (3) I am a bald Aries.

Ellis Cooper

Dear Editor:

Many thanks for your kind review of "I'm Madly in Love with Electricity." We have been tremendously pleased with the number of mail requests received from around the country, and almost all of this is due to people like yourself who have publicized it in journals.

On behalf of all of us who worked on the booklet, thank you!

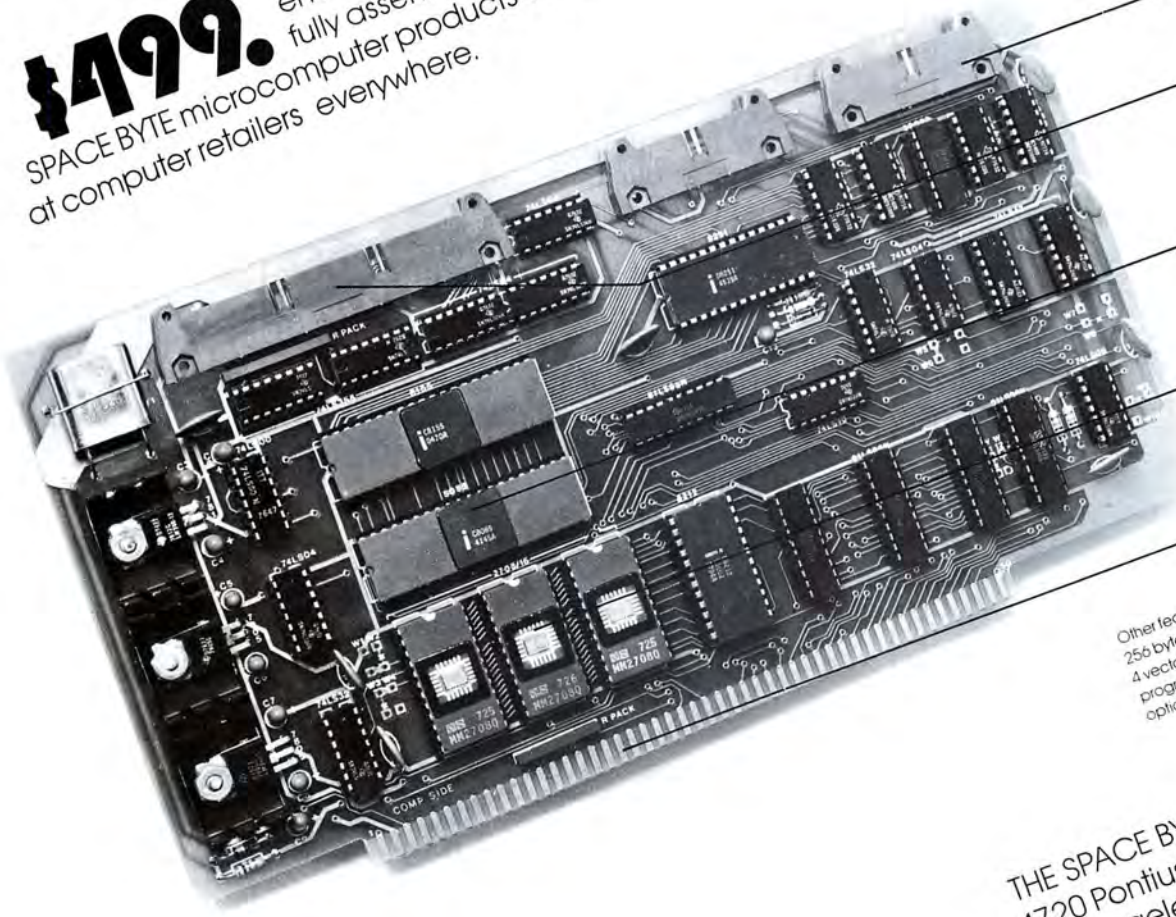
Nancy Kreinberg
University of California
Lawrence Hall of Science
Berkeley, CA 94720

We are a young publication in a young field and are dedicated to the belief that the computer is totally gender-blind. We are seeking articles from women computerists. Our goal is a 50% mix. —Editor

Branched to Page 49

Introducing the SPACE BYTE™ 8085 CPU A self-contained computer

$499. end user quantity one.
fully assembled, burned in and tested.
SPACE BYTE microcomputer products are available now at computer retailers everywhere.



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Fully buffered parallel I/O ports interface directly with the ICOM® FD 3700 or Frugal Floppy disk systems

The state of the art INTEL® 8085 CPU is 50% faster than the 8080A. It operates at 3MHz, using 450 ns memory and is fully compatible with all existing 8080 software

Complete 3K system monitor with 2708* EPROMS including extensive de-bugging, FDOS Tarbell and video driver routines. * Jumper selectable for use with 2716 EPROMS for up to 6K of on board system monitor

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UPDATE

MACBETH COLOR COURSE

Practical application of new color technologies is the subject of an innovative series of training courses being offered this year by Macbeth, a division of the Kollmorgen Corp.

The one-week courses make available to those taking them the considerable expertise of both Macbeth and Munsell Color, an integral part of the Macbeth Division and long recognized as a leader in the color field.

The format of the course will underscore practical application of colorant formulation theory. Included in the course are discussions of methods to describe and measure color; color differences, specifications and tolerances; theories and how to apply them; and the application of instrumental techniques.

The basic information is presented in such a manner that each student can perform actual color matching experiments, with daily sessions scheduled to be segmented between lecture and lab work.

Courses are scheduled at both Newburgh, N.Y. and Tatamy, PA, for the weeks of February 20, May 15, September 18, and December 4. Cost of the course is $350 and includes textbooks, all necessary supplies, reference material, lunches and an evening banquet.

For more information, contact either Dr. J.G. Davidson, Macbeth, Little Britain Rd., Drawer 950, Newburgh, N.Y. 12550, (914) 561-7300 or H.R. Davidson, P.O. Box 157, Tatamy, PA 18055, (215) 252-2120.

PERCOMP '78

Eight free seminars, tutorials and demonstrations are scheduled for PERCOMP '78, April 28-30 at the Long Beach Convention Center, Long Beach, California.

The papers run the gamut from the very basic to the super sophisticated, and also encompass the lighter aspects of computer games, music and household use.

Included are the following presentations: "Marketing for the New Manufacturer," David Ahl, Creative Computing; "Three Dimensional Microcomputer Graphics," Bruce Artwick, Sublogic; "6530 Timer Programming," Arthur Stoll, Rockwell International; "Human Factors in Software Design," Jack Emmerichs, A.O. Smith; "Computer Games," James Butterfield, author of *The First Book of KIM*; "Getting Started in Microcomputers," Louis Fields, president, International Computer Society/SCCS; "The 'Jogger' Microprocessor Communication Bus," Dr. Keith L. Dotty, University of Florida.

Dr. Portia Isaacson, chairperson for the ACM Personal Computing Group, will conduct a session for retailers, while attorneys Leonard Tachner and Kenneth Widelitz will take computer enthusiasts through thelabyrinth of tax benefits, patents and copyrights.

Carol Ogdin, Software Technique, Inc., will deliver the keynote address. She will address the subject of proven home applications of the computer.

For further information, write PERCOMP '78, 1833 E. 17 St., Santa Ana, CA 92701.

CALL FOR PAPERS

A Call for Papers has been issued for the International Microcomputers Minicomputers Microprocessors '78 Conference to be held June 20-22, 1978 at the Palais des Exposi-

tion in Geneva, Switzerland. The subject matter includes Microcomputer Technology, Software Development Systems and Tools, Advances in Software Technology, Peripherals for Minicomptuers and Microcomputers, Industrial Control and Automation Applications, Small Business Systems, Military/Aerospace Applications, Communications Applications of Microcomputers and LSI Devices, Personal Computing, Testing and Standardization, Multiprocessing/Instrumentation Applications of Microprocessors.

Abstract due date is February 15, 1978. Announcement of selected papers will be made on or about March 1, 1978. A Proceedings will be published. For further information contact Dr. Fred L. Morritz, V.P., Technical Programs, Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

ISRATECH '78

American executives visiting IsraTech '78 will meet in Israel with the Minister of Industry, Commerce and Tourists and with the Mayor of Jerusalem as part of the schedule of events announced by the Government of Israel Economic Offices.

IsraTech '78, an exposition of Israel's rapidly growing high technology industries, is scheduled for June 4th to 8th, 1978 in Jerusalem. It will be the most significant economic event of Israel's thirtieth anniversary.

In addition to meeting with Minister Hurvitz and Mayor Kollek, attending executives will meet with Israel's manufacturers and government representatives to discuss a vast number of business opportunities in Israel, such as buying, selling, investing and licensing. Executives will also attend an International Meeting of the Metalworking and Professional Electronics Committee, will tour industrial plants and research and development facilities, and will be guests at official banquets and receptions.

While attending a modern exposition, executives and their families will also be able to visit the sites of one of the world's most historic cities. The program for IsraTech '78 will include tours of the Israel Museum, cultural evenings, and a special program designed for accompanying persons.

Hundreds of American businessmen are expected to attend IsraTech '78, which will provide them with broad exposure to Israel's high technology industries. The industries that will be exhibiting will include: metal processing, equipment and machinery manufacturing, electrical systems and parts, systems and components, electronics, computers, instrumentation, aerospace and military applications.

The metal and electronics industries, government sources projected, will have enjoyed a five fold export growth between 1972 and 1978, from $115 million to $580 million.

At the exhibition visiting executives will also have an opportunity to discuss with their Israel counterparts and with representatives of the Government the unique advantages Israel offers potential foreign investors. Among these benefits are:

- Common Market agreement providing duty-free entry to the 270 million person Common Market by manufacturing for export in Israel.

UPDATE

- Israel enjoys the Generalized System of Preferences by which 2,700 Israel-made product categories can be imported to the U.S. duty-free.
- U.S. companies will be exempt from double taxation on profits earned in Israel under a soon to be ratified, and already signed, tax treaty.
- Israel offers a generous package of financial and operating incentives to encourage U.S. companies to locate production facilities there, including financing most of the fixed assets and working capital needed.
- Israel actively supports industrial research and development activities with grants of 50% of R&D costs; moreover, Israel and the U.S. recently established the Binational Industrial Research and Development Foundation, which has been allocated $60 million to fund joint R&D projects.

For further information contact the Government of Israel Investment Authority, 641 Lexington Ave., New York, N.Y. 10022, (212) 486-8530.

LOGICAL MACHINE CORPORATION ACQUIRES BYTE, INCORPORATED

Logical Machine Corporation, manufacturer of the ADAM business computer, announces the acquisition of Byte, Incorporated of Sunnyvale, California as a wholly-owned but independent subsidiary. Founded two years ago as a retail store in nearby Mountain View, California, the original Byte Shop sold microprocessing equipment and literature to hobbyists. Byte, Incorporated evolved from this single shop and now has a network of approximately sixty independent dealerships throughout the country. Each store uses the name Byte Shop™, a recognized trademark. Byte, Incorporated, in order to stay on top of a dynamic market, will continue to expand in the business, home and personal computer markets.

Byte, Incorporated is currently composed of two primary divisions: distribution and manufacturing. The distribution division supplies the Byte Shops with periodicals, manuals, microprocessors, and other computing equipment. The manufacturing division produces a microprocessor which is sold as an integrated system through the Byte Shops.

NEW COMPUTER STORES

"Home Computer Centers" are now open in Virginia Beach and Newport News, Cirginia. These are full service microcomputer stores catering to hobbyist, homeowner, schools, business, and industry. Nearly 60 years of professional experience in the computer field are brought together in this enterprise. Three man-years of research insure a knowledgeable and dependable solution to each requirement. Product lines include: Apple II, Processor Technology, Vector Graphic, PolyMorphic Systems, Technical Design Labs, Dec and TI terminals, parts, books and magazines. Software, consultation and service are also available. The addresses are: Home Computer Center, 2927 Virginia Beach Blvd., Virginia Beach, VA 23452, (804) 340-1977. Home Computer Center, 12588 Warwick Blvd., Newport News, VA 23606, (804) 595-1955.

COURSE IN DIGITAL ELECTRONICS & MICROCOMPUTER INTERFACING

Virginia Military Institute will conduct a two-week course in digital electronics and microcomputer interfacing from July 17 through July 29, 1978.

Branched to Page 20

New UVS-11E EPROM Erasing System

Performance and Reliability for $59.50

Now available . . . the newest member of UVP's growing family of quality EPROM Erasing Lamps. The UVS-11E Short Wave UV Lamp was designed specifically for the small systems user and computer hobbyist. It's compact, easy-to-use, and will erase up to 4 chips at one time. It even features a special safety interlock system for complete safety.

This is the first UV erasing system to offer simple operation and foolproof safety features at an affordable price. Like all UVP products, the UVS-11E is quality-built and backed by 45 years of UV technology.

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This is a hands-on course designed for both academic and industrial personnel who are interested in the implementation of microcomputer techniques to solve problems in computer interfacing. Lecture and laboratory topics will include instruction in the fundamentals of digital electronics, the 8080 microprocessor and standard interfacing techniques. Software development aids will be available.

This course provides an opportunity for professional growth in this popular technological area as well as a vacation in the historic and beautiful Shenandoah Valley of Virginia. Tuition will be $350.00, of which $100.00 deposit will be required by April 5, 1978. Academic credit is available through James Madison University.

For information and registration forms write to Dr. Philip B. Peters, Dept. of Physics, VMI, Lexington, VA 24450.

CALL FOR PAPERS

A Personal Computing Festival will share the public spotlight in conjunction with the 1978 National Computer Conference to be held June 5-8 in Anaheim, California. A Call for Papers has been issued for the Festival Program which will be held June 6-8 at the Disneyland Hotel adjacent to the Anaheim Convention Center. Included as part of the three day program will be presentations of invited papers, contributed papers, tutorials, as well as panel discussions relevant to personal computing. Letters of intent to participate as either an author, panelist or session chairman must be submitted by *February 1, 1978.* Authors who have received notification of acceptance must submit final papers by *March 15, 1978* in a specified camera-ready format.

Approximately 30 sessions are planned with emphasis on the following areas, although papers and session proposals on other topics are encouraged: tutorials for computer novices; speech synthesis and speech recognition; computer-driven and computer-assisted music systems; computer graphics and video art; personal computers for the physically disabled; personal computers for education; business systems using "home" computers; hardware and software design and implementation; standards for hardware, interfaces and software.

Papers presented during the Festival Program will be published in a softbound book, *Festival Digest '78,* which will be available during the NCC.

Potential authors should immediately send a "letter of intent" including an abstract of their proposed talk to Jim C. Warren, Jr., Star Route Box 111, Redwood City, CA 94062; (415) 851-7664. Authors will be mailed the Festival Author Kit, which contains author instructions and the necessary materials for preparing the camera-ready copy.

Session Chairmen must submit two copies of a 250 word abstract describing the scope of the proposed sessions and tentative title of presentations by *February 1, 1978.* In the case of panel sessions, the prospective organizer should list proposed panelists, their titles and affiliations, and a brief biography of each speaker. Prospective session chairmen will be notified as the disposition of suggested sessions by *February 10, 1978.*

Information on NCC '78 may be obtained from AFIPS, 210 Summit Ave., Montvale, NJ 07645, (201) 391-9810. **Branched to Page 25**

"A splendid performance in three acts"

ACT-I

Known for its dependability, ease of interfacing, utility and affordable price, the ACT-I enjoys its reputation as one of the most popular "glass teletypes" on the market. If your computer system communicates in serial ASCII, the ACT-I could be just the tool you need to get online.

The ACT-I computer terminal manages a 1024 character display organized as 16 lines of 64 characters selected from the standard upper case ASCII set. Receipt of more than 64 characters on a line or the Line Feed code initiates a scroll operation.

STANDARD ACT-I FEATURES INCLUDE:

Switch selectable data rates of: 110, 300, 600, 1200, 2400, 4800, 9600, and 19200 Baud.

Switch selectable UART options: Odd, even, or no parity, one or two stop bits.

Jumper Selectable Interface: RS232C, 20MA current loop or TTL voltage levels.

- Handsome, rugged, lightweight aluminum cabinet
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- Clear sharp video output signal (RS170 standard) capable of driving any CRT monitor

Price $400. A cursor control/bell option is available for $25.00.

ACT-II

We've added the convenience of an acoustically coupled modem to the economy and performance of the ACT-I to create the ACT-II. Designed to communicate either with remote processors through its modem, or with local computers via its RS232C or 20MA current-loop interfaces, the ACT-II offers versatility unheard of at its low price. The ACT-II (without monitor) slips easily into an attache case (4 × 14 × 11 inches) to commute with you between work and home.

The ACT-II's demodulator employs four stages of active filtering to minimize the bit error rate of the receiver. If you are eager to join the ranks of those who sit at home and enjoy the use of a powerful computer system across town, the ACT-II can be your "password".

As a further convenience feature, the modulator input and demodulator output are available at jacks on the rear of the ACT-II cabinet so that you may link a local serial device (such as a digital casette tape or even your own computer system) to the remote computer through the internal modem.

The ACT-II can be purchased for only $550.00

ACT-IV

If you're looking for a low priced high powered terminal, consider these features which are all standard with MICRO-TERM's ACT-IV:

DISPLAY: Upper and descending lower case characters, 24 lines of 80 characters, and auto-scrolling.

KEYBOARD: Full ASCII with cursor controls and auto-repeat on several keys.

TRANSMISSION MODES: Character by character or "page" mode.

SPECIAL FUNCTIONS: relative and absolute cursor addressing, home up, erase to end of line, erase to end of screen, fixed tabs, report cursor position, and display control characters.

EDITING: in PAGE mode, the user can insert or delete characters on any line and insert or delete lines on the page.

DATA RATE: 300 to 19200 baud (Switch selectable on rear)

The ACT-IVa comes in a compact (briefcase compatible) cabinet without video monitor for $550.

The ACT-IVb comes complete with a 12" monitor and numeric keypad in a single enclosure for $800.

Optional available features: separate printer port (110-9600 baud) $50.

GENERAL INFORMATION:

All MICRO-TERM products are fully assembled, tested and guaranteed for 90 days. The entire MICRO-TERM product line is available from stock at discriminating computer stores or may be purchased directly from the factory. All prices are less monitors (which start at $130.00) F.O.B. St. Louis, Missouri.

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INTERFACE AGE

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Introduction to Microprocessor Technology; Bubble Memories Are Coming; Calculatin' Engines; Teleprinter Maintenance; Altair Alterations.

Vol. 1, Issue 6, MAY, 1976 (Very Limited Quantities)
War of the Microprocessors; Simplify Your Digital Design; No Such Thing as Cheap Timesharing?; The IMSAI 8080; Polymorphic Systems

Vol. 1, Issue 9, AUGUST, 1976
Color Graphics: A Beginning; A New Pony—The Altair 8800B; BASIC—An Easy Programming Language; Biorhythms in Practice

Vol. 1, Issue 11, OCTOBER, 1976
National's New Portable Terminal; SA-400 Mini-floppy; CSC—Experimentor 300/600; Software Power for Your 6800; ESP-1 Software Package

Vol. 1, Issue 12, NOVEMBER, 1976
Build a Simple A to D; Super Chip FD1771; RCA ASCII Keyboard Modifications; Protecting Stored Programs; New Product Guide; SWTPC 6800 ROBIT-1

Vol. 2, Issue 2, JANUARY, 1977
A CRT Terminal Using the M6800 Chip Family; AMI's EVK Series Microcomputer; Build a 3 Digit A/D; Microcomputer Design Aides; Cromemco Bytesaver™

Vol. 2, Issue 3, FEBRUARY, 1977
8080 Octal Monitor Program; Legion: An Experiment in Artificial Intelligence; Microcomputer Stock Options; Building a 12-Bit A to D Converter

Vol. 2, Issue 4, MARCH, 1977
Menace of the Micro World; New Product Guide; The Qube; Card of the Month—Cromemco T.V. Dazzler™; Z-80 MITS 12K Extended BASIC Patches.

Vol. 2, Issue 5, APRIL, 1977
"Mike"—A Computer Controlled Robot; L.E.D. Flasher (For Dasher—Or Any Other); Robots As Household Pets; The Remotoid/Android Project

Vol. 2, Issue 6, MAY, 1977
Computrac 2000; The Floppy-ROM™ Experiment; Robert Uiterwyk's 4K BASIC Interpreter Program; Help Your Computer Understand Your Voice

Vol. 2, Issue 8, JULY, 1977
Diablo Output Driver Routine; Some Further Notes on Robert Uiterwyk's Floppy ROM 4K BASIC; Microcomputerized Combination Lock; PIA Test-IOTST

Vol. 2, Issue 9, AUGUST, 1977
The Shadow of What?; A KIM-1 Sidereal/Solar Clock; Solar Eclipse Prediction by Microcomputer; Viking UPLINK/DOWNLINK; Star-Ship Simulation-Part I

Vol. 2, Issue 10, SEPTEMBER, 1977
General Ledger Program; Microcomputers: The Intelligent Terminals; Star-Ship Simulation-Part II; PerSci Intelligent Floppy Disc Controller

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INFO 2000 DISK SYSTEM

FOR: HEATHKIT H8 COMPUTERS
DIGITAL GROUP Z80 COMPUTERS
ALL S-100 COMPUTERS

YOUR QUESTIONS ANSWERED.....

What is the INFO 2000 DISK SYSTEM?

The **INFO 2000 Disk System** is a complete dual floppy disk system for your S-100, Heathkit H8, or Digital Group microcomputer. It incorporates the fastest dual diskette drive (PerSci 277) and the most sophisticated intelligent controller (PerSci 1070) available to provide the highest performance and greatest functional capability of any mass-storage system you can buy for your microcomputer. INFO 2000 supports this Disk System with the best and most complete library of operating software available anywhere. The complete **INFO 2000 Disk System** is delivered assembled and fully tested to assure you of an uneventful plug-in-and-go installation in your microcomputer.

WHAT KIND OF COMPUTERS CAN USE THE INFO 2000 DISK SYSTEM?

If you have a Digital Group Z80 system, Heathkit H8, or any S-100 bus computer which uses the Z80 microprocessor, the **INFO 2000 Disk System** and supporting software library will work with it. INFO 2000 provides its customers with the unique service of customizing its software to operate with whatever I/O configuration you are using (within reasonable limits) at no additional cost. The **INFO 2000 Disk System** and software are being used today with Altair, BYT-8, Cromemco Z-2 (at 4 Mhz), Digital Group, Heathkit H8, IMSAI, Poly 88, Processor Technology SOL, TDL Xitan, T.E.I., Vector Graphic, and other microcomputer mainframes. If your computer uses an 8080 processor with the S-100 or Digital Group bus, you can use our hardware without modification; however, you must upgrade your computer to a Z80 in order to use our library of software.

WHAT ARE THE TECHNICAL DIFFERENCES BETWEEN THE INFO 2000 DISK SYSTEM AND OTHERS?

The **INFO 2000 Disk System** is the only one which has an intelligent controller with its own on-board microprocessor and file management firmware. It is the only one which provides all of the EPROM and RAM needed for its disk Monitor software, and therefore does not use up a single byte of your system RAM. It uses the industry-standard single-density FM recording technique and soft-sectored diskettes to provide nearly complete immunity to read/write errors. (Double-density recording is extremely intolerant to speed variations, dirty heads, flawed media, etc., and so is an order of magnitude less reliable.) It offers the most complete software support of any disk system. And it is available for all S-100, Heathkit H8 and Digital Group systems with total file and program interchangeability.

WHAT MAKES YOU SAY THAT YOUR PRICES ARE LOWER THAN OTHERS?

Let's look at the cost of the **INFO 2000 Disk System** in comparison to the most comparable disk systems from Cromemco and IMSAI:

CROMEMCO	IMSAI	INFO 2000
8" Dual Drive Assembled with Case and Power Supply		
$2,495	$2,390	$2,650
S-100 Controller Assembled		
595	599	Included
TOTAL DISK SYSTEM		
$3,090	**$2,989**	**$2,650**

If the cost of software is included in the comparison, the INFO 2000 cost picture looks even more favorable. (For example, our disk monitor on EPROM is included in the $2,650 price, while their disk-resident monitors cost $75 to $100 extra.) Similar "apples-with-apples" price comparisons between the **INFO 2000 Disk System** and the Processor Technology Helios, the iCOM dual 8" system, and other competitive systems yield similar results. However, we think you should buy the **INFO 2000 Disk System** because it is the best on the market, not because it is the cheapest.

HOW ABOUT THE TWO-DRIVE MINI-FLOPPY SYSTEMS THAT ARE UNDER $1,500?

Minifloppies seem like quite a bargain, until you realize that they are about half the cost of the full-size 8" diskette systems but offer only one-third of the capacity and one-sixth of the speed. Our experience indicates that minifloppies are an attractive alternative to cassettes for loading programs, but are simply not viable for serious data management work such as business applications.

WHAT ELSE DOES INFO 2000 SELL?

An increasingly important part of our business is helping customers to configure and acquire complete disk-based microcomputer systems optimized for their specific requirements. You may be interested in discussing the advantages of purchasing a total computer system from INFO 2000, and having us assemble and test the entire configuration together before it is delivered to you.

DOES INFO 2000 SELL SOFTWARE TO ACCOMPANY ITS DISK SYSTEMS?

We offer the most extensive library of software available anywhere. This includes TDL 12K Super BASIC (extended for disk), Text Output Processor, Relocating Macro Assembler, Z-tel Text Editing Language, and ANSI Standard FORTRAN IV. We also have Digital Research CP/M Monitor and much more software. Please write for all the details.

INFO 2000 normally ships disk systems orders within two to four weeks after receiving your certified check, cashier's check or money order. C.O.D. orders are accepted with a 20% deposit. INFO 2000 extends a 5% discount on Disk System orders to retail customers who include payment in full at the time of order. California residents add 6% sales tax. Dealer inquiries welcomed.

Please feel free to write or phone INFO 2000 with any questions you may have regarding our products. At INFO 2000 we take pride in providing personal consultation and support to our customers. We look forward to hearing from you.

ATTENTION: HEATHKIT H8 OWNERS . . . . .

Now INFO 2000 offers its high-performance Disk System for your Heathkit H8 Computer, and upgrades your system to a Z80 in the process! Simply unplug your Heathkit 8080 CPU board, and replace it with the **INFO 2000 Z80/Disk Adapter Board** instead. This remarkable board combines a Z80 microprocessor and all support chips, 7K of EPROM and 1K of scratchpad RAM for the **INFO 2000 Disk Monitor.** and all logic necessary to interface the **INFO 2000 Disk System** to the Heathkit H8.

With the INFO 2000 Z80/Disk Adapter board installed, your H8 Computer can operate in either of two switch-selectable modes. One mode permits the use of the Heath H8 EPROM monitor and all existing Benton Harbor software without modification (but provides the speed advantages and extended instruction set of the Z80). The other mode supports the INFO 2000 Disk Monitor and all INFO 2000 software including the TDL software library and CP/M.

The complete **INFO 2000 Disk System** for the Heathkit H8 costs $2,750 – this is $100 more than our S-100 and Digital Group systems, but includes the upgrade to a Z80 processor as part of the deal. Contact INFO 2000 for further details of this exciting new product.

INFO 2000
CORPORATION
20630 South Leapwood Avenue
Carson, California 90746
(213) 532-1702

CALENDAR

Feb 1 New England Computer Society will meet in the cafeteria of the MITRE Corp. at 7:00 P.M. Located on Route 62 in Bedford, MA. Contact Dave Day at (603) 434-4239 for details.

Feb 1 Kitchener Waterloo Microcomputer Club will meet at the University of Waterloo, Room 3388, Engineering Bldg. #4, University Ave., Waterloo, Ontario, Canada at 7:30 P.M.

Feb 1 Northwest Computer Society will meet in the Pacific Science Center in Seattle, Room 200 at 7:30 P.M. For more details write NCCN, Box 242, Renton, WA 98055.

Feb 1 The Valley Computer Club will meet at 7 P.M. at the Harvard School located at 3700 Coldwater Canyon, Studio City, CA.

Feb 1 Lincoln Computer Club will hold its meeting at the South Branch Library located on 27th and South Sts. at 7 P.M. For more details write Hubert Paulson, Jr., 422 Dale Dr., Lincoln, NE 68510.

Feb 2 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Feb 2 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

Feb 4 The Computer Hobbyist Group, will meet at 1 P.M. in Green Center, Room 2.530, campus of University of Texas, Dallas. For further information write the club at P.O. Box 11344, Grand Prairie, TX 75051.

Feb 4 Louisville Area Computer Club (LACE) will meet at the University of Louisville, Speed School Auditorium at 1 P.M. For details, write the club at 115 Edgemont Dr., New Alban, IN 47150.

Feb 4 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. Call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

Feb 4 Oklahoma Computer Club will be meeting at the Belle Aisle Library at 10 A.M. Call Al Campbell at (405) 842-4933 for details.

Feb 4 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

Feb 4 Milwaukee Area Computer Club will meet at 1 P.M. at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.

Feb 6 Minnesota Computer Society will meet at the Brown Institute, Room 51, 3123 E. Lake Street, Minneapolis, MN. For further information contact the Society at Box 35317, Minneapolis, MN 55435, Attn: Jean Rice.

Feb 7 Tidewater Computer Club will hold its meeting at the Electronics Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. For further information contact: C. Dawson Yeomans, Interface Chairman, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

Feb 9 Mid America Computer Hobbyist meeting will be at 7:00 P.M. at Commercial Federal Savings & Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Feb 9 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7 P.M. For details write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

Feb 9 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For details write RAMS, P.O. Box D, Rochester, NY 14609.

Feb 10 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8, at 7 P.M. For details write NNJACC, 593 New York Ave., Lyndhurst, NJ 07071.

Feb 11 The Permian Basin Computer Group — Odessa Chapter meets at 1 P.M. in the Electronic Technology Bldg., Room 203 on the Odessa College campus. For details call (915) 332-9151.

Feb 12 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 105 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-9722 evenings.

Feb 15 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA at the Stanford Linear Accelerator Center Auditorium. Call (415) 967-6754 for more details.

Feb 17 Long Island Computer Association will meet at 7 PM at the New York Institute of Technology, Old Westbury Campus, Route 25A between Route 107 and Glen Cove Rd., Rm. 508. For more details write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

Feb 17 Amateur Computer Group of New Jersey (ACGNJ) will meet at UCTI, 1776 Raritan Rd., Scotch Plains, NJ 07076 at 7 P.M. For further information write to the club at the above address.

FEB 18 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

Feb 18 San Diego Computer Society will meet at the Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA. Doors open at 12:30. For details call (714) 565-1738.

Feb 18 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

Feb 18 Central Florida Computer Club will meet at the Orlando Utility Bldg., on S. Orange Ave., Orlando, FL at 2:00 P.M.

Feb 18 Philadelphia Area Computer Society will meet at 2 PM at LaSalle College Science Bldg. at the corner of 20th & Olney Ave. For more details write PACS, P.O. Box 1954, Philadelphia, PA 19105.

Feb 19 Chicago Area Computer Hobbyist Exchange (CACHE) will meet at 12:00 P.M. in the Nigas Bldg. Cafeteria located on Schermer Rd. in Glenview, IL. Call CACHE Hotline (312) 849-1132 for details.

Feb 21 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., on 59 St. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Feb 22 Tidewater Computer Club will hold its meeting at the Electronics Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. For further information contact: C. Dawson Yeomans, Interface Chairman, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

Feb 22 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, near the Willow Pass exit of Fwy. 680,

from 8-10 PM. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

Feb 22 Boston Computer Society will meet at the Commonwealth School, 151 Commonwealth Ave., Boston at 7 P.M. The school is located on the corner of Dartmouth St. in Boston's Back Bay. For information write or call the society at 17 Chestnut St., Boston, MA 02108, (617) 227-1399.

Feb 22 Ventura County Computer Society will meet at Camarillo Public Library, 3100 Ponderosa Dr., Port Hueneme, CA 93041 at 7:30 P.M. For more information write: VCCS, P.O. Box 525, Port Hueneme, CA 93041.

Feb 23 Space Coast Microcomputer Club will hold its meeting at 7:30 P.M. at the Merritt Island Library, Merritt Is., FL. Contact Ray Lockwood at (305) 452-2159 for details.

Feb 23 Small Computer Engineering Association of Minnesota (SCEAM) will meet at the Resource Access Center, 3010 Fourth Ave. So., Minneapolis, MN 55408 at 7 P.M. For more information write to this address or call (612) 824-6406.

Feb 24 Alamo Computer Enthusiast meets at 7:30 P.M. in Room 104 at Chapman Graduate Center at Trinity University, San Antonio, TX. For details call (512) 532-2340, or write to the club at 7517 Jonquill, San Antonio, TX 78233.

Feb 24 Washington Amateur Computer Society has scheduled its meeting to be held at the Catholic University of America, St. Johns Hall. Located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

Feb 24 University of Minnesota Microcomputer Users Group (UMMUG) will hold its meeting at the University of Minnesota, Electrical Eng. Rm. 115 at 7 P.M.

Feb 24 TRACE will hold its meeting at the Ontario Science Center, 8 P.M., 770 Don Mills Road, Don Mills, Ontario. Club address is Box 545, Streetsville, Ontario, Canada L5M 2C1.

Feb 26 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Ft. Wayne, IN. For details write the club at P.O. Box 5096, Ft. Wayne, IN 46805.

Feb 28 Computer Amateurs of South Jersey will holds its meeting at the National Park Municipal Bldg., 7 So. Grove Ave., National Park, NJ at 7:30 P.M. For details call (609) 541-1010, or (609) 541-8296.

UPDATE

COMPUTER COUNTRY

A retail computer store called Computer Country in Tustin, California, offers microcomputer systems for application in the home, education and business. These microcomputer systems are at the heart of video games, word processing, inventory control and financial reporting systems. These systems are also part of burglar alarms, smoke/fire detection, Christmas mailing lists, and message recording systems for telephone answering bureaus.

Computer Country systems are already being applied to jobs in auto tire retreading, information systems for the blind and inventory control for a motorcycle parts manufacturer.

The store is oriented toward the practical computer user and offers a number of classroom training programs. These include: Preparing the Business Man for Data Processing, Basic Language Programming, and Star Trek, an advanced video game for adults and children.

The founders of Computer Country are planning to franchise a network of independently owned stores throughout the United States and abroad. The pilot store is in Larwin Square Center in Tustin, California. The store has a complete line of microcomputers and software products including microcomputers from IMSAI, Apple, RCA, Atari, and Applied Data Communications.

The founders of the company are Mr. Kenneth D. Allen, who heads the firm and was formerly President of Microline Corp. and Microdata Corp. in Irvine, California; Mr. Don Berry, currently Vice President of Engineering for GTE's Information System Group in Anaheim, California; and Mr. Clifton Myers, Vice President of Systems and formerly Director of Management Information Systems at Microdata Corporation in Irvine, California.

Franchising operations will be headquartered in a new facility under construction at the Airport Industrial Complex in Irvine, California.

PROGRAMS IN BOOK FORM

The very low cost microcomputer hardware systems are finally being matched by low cost software. Osborne & Associates are producing, in book form, business application programs with documentation. These are programs that have traditionally sold for many thousands of dollars. In book form these programs, plus documentation, are available for $12.50. There are interesting legal

Vectored from Page 20

ramifications to these books, since they copyright the printed word, but do not protect the magnetic surface. This means that anyone can modify or resell the programs without paying a license fee, providing the programs are sold in a computer-readable form and not in a human-readable form. While international controversy rages regarding ability to patent or legally protect software, the appearance of programs in book form lends a new dimension to an already tricky legal problem.

For the next 12 months, small business data processing apparently will represent the most significant outlet for microcomputer systems. There are probably hundreds of such systems being installed every month, sold by computer stores and by direct sales from the manufacturer. This very significant installed base is being ignored by most surveys of small business computer systems. In all probability, the surveys are therefore highly distorted.

MINI/MICRO78 IN PHILADELPHIA!

The 1978 MINI/MICRO COMPUTER CONFERENCE AND EXPOSITION is scheduled for the Philadelphia Civic Center next April 18-20 (Tuesday through Thursday).

According to a respected industry source, International Data Corporation (IDC), the Philadelphia area ranks as the fifth largest computer marketplace in the country, and is easily accessible from the No. 1 (New York) and No. 4 (Washington, D.C. area) major computer markets in the nation. And, again quoting IDC, 90 percent of annual expenditures come from current U.S. computer users.

For registration and further information contact Mini/Micro 78 at 5528 E. La Palma Avenue, Suite 1, Anaheim, CA 92807 (714) 528-2400.

ROACHES BUGGING TRAIN COMPUTERS

In Tokyo, Japanese railways have declared war on cockroaches that are upsetting the computers on the high-speed Shinkansen train running between Tokyo and Hakata.

A cockroach recently got into the speed-measurement circuit on one train, so that the computer recorded a speed of 130 miles an hour while it was standing in Nagoya station.

WHITE COLLAR MICROCOMPUTER

By James S. White

Microcomputers for small businesses! A computer for your business? As a small businessman, you certainly are well aware of many of the benefits that computers accord to large businesses, benefits so great that the opportunities of a large business without a computer are unthinkable today. Thus you have some feeling of the potential that computers hold for your small business. However, many small businessmen properly question whether a computer would be a beneficial tool for them yet, and aren't sure how to evaluate the place of a computer in their business.

As a reader of INTERFACE AGE, you are aware that today you can afford to own a computer, the computer hardware, that is. Whether you can afford all the costs of a computer system package is quite a different matter. It is quite possible for a small business owner or manager to program his own computer. Some do this; do-it-yourself programming may even be realistic for some small businessmen.

Consequently, it seems that many of the benefits of computers may be within your grasp. You may be able to receive better and/or quicker information, perhaps about your business, the marketplace, and the competition. You may be able to save a considerable amount of the time and/or money you or your employees presently require to do certain functions. You may be able to expand your business, using your computer to help overcome previous limitations. You may be able to increase the quality of your products or services, or to optimize your operations towards producing what you can sell or selling what you can produce. In many other ways, you may be able to benefit from those computer contributions that are, for you, in the important-to-improve areas of your business.

What are the characteristics of computers that allow them to provide these benefits? First is the computer's ability to function as a calculator, a skill about which you are probably quite familiar. Another key computer characteristic is its large, quick memory; a small business computer (using disc storage) can "remember" more than 100,000 numbers (for example, stock numbers and corresponding wholesale and retail prices) and instantly "recall" desired information. A computer, after having been suitably programmed, can also compare alternatives — you might ask your computer to find the most profitable (or best against other criteria) way to invest the limited number of dollars you can allocate to inventory. It can help you to prepare sales calls, or do any other business operation.

The real key, however, to a computer's power is that it can do these things very quickly, almost perfectly, over and over again in the same way. Or, if you prefer, your computer can repeat its work in a similar way, varying its operations depending on the characteristics of the data with which it is given to work. A computer can "check through" its records for your entire 100,000-item inventory every day, or even every hour if you want. If you have a task that requires a large, long amount of work, the computer will work all night, generally without a mistake, and have the answer ready for you first thing the next morning. To top this all off, your computer will do all this without asking for a vacation or for a day off for its great-aunt's funeral, and will never ask for a raise (although its repairman might) or get bored.

This all sounds great, you may be thinking, but how can I reach these benefits and make a computer part of my organization? Much more important, how might I decide if a computer belongs in my organization? The first part of the answer comes from scrutinizing your own business.

Unfortunately, it is easy to take a different approach: to start computer considerations by looking at memory sizes, operating speeds, and instruction sets. Computer vendors are generally very comfortable talking in these terms, and much of today's literature is oriented to topics such as these. True, objective characteristics should not be ignored when selecting a computer. However, because these characteristics tend to be relatively easy to compare and also exciting to look at, or at least fun, they often obscure more important considerations.

For a businessman, starting with hardware considerations is usually putting the cart before the horse. The motive force for your computing involvement is your business; how can you improve it, or maintain it at less cost? Therefore your business is where your computer considerations logically begin, and remain for a while. Even after some business planning has been done and some computing decisions tentatively made, it is usually very worthwhile to return and further review business plans in additional detail, particularly considering characteristics that computer planning have shown to be important.

Probably the best way to start making your decision about the place of a computer in a business is first to learn about the business itself. This may sound ridiculous — what owner or manager doesn't understand his own business? Many don't, to the degree of detail necessary.

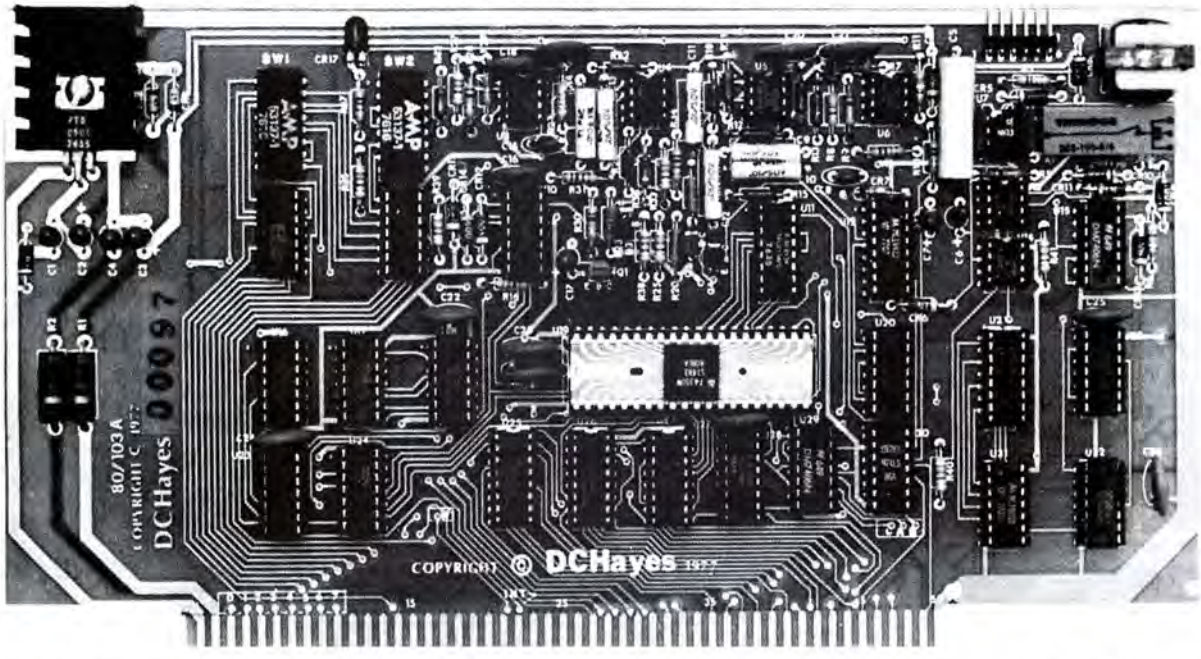
If you presently do all your own record keeping, forecasting, process control or whatever it is that you are thinking a computer might do for you, you may know much of what you need for computer planning. It is also important to consider why these things are done in the way that they are. What other ways could these things be done with a tool having capabilities somewhat different than yours? And what are the rules to follow under *all* possible conditions, including ones you have never encountered before? A computer must be given instructions on handling every condition. The instructions can be as simple as to call for help from a human, or to treat the condition the same as another, normal condition.

An owner or general manager who has delegated some of the business operation to someone else also needs, in order to plan for a computer, to know how and why the other persons

TIMESHARING

The 80-103A works both ways. Your system can call a timesharing service and communicate as an intelligent terminal *OR* your S-100 system can be the timesharing system where the 80-103A answers the phone and communicates with terminals or other processors.

80-103A DATA COMMUNICATIONS ADAPTER



The 80-103A DATA COMMUNICATIONS ADAPTER was developed to function as an S-100 bus compatible serial interface incorporating a fully programmable modem and Telco interface. These functions are usually accomplished by the use of two separate modules: 1) a serial I/O board, and 2) an external modem. By combining these features on a single board, the 80-103A can offer microcomputer applications significant cost/performance advantages over other implementations.

- FULLY PROGRAMMABLE FEATURES
- AUTOMATED DIALING AND ANSWER
- ORIGINATE OR ANSWER MODE
- 110-300 BIT/SEC DATA RATES
- CHARACTER FORMAT AND PARITY
- ERROR DETECTION
- FULLY BUFFERED, OUTPUTS DRIVE 25 S-100 BUS LOADS
- STANDARD U.S. FREQUENCIES
- FULL TELCO COMPATIBILITY WHEN ATTACHED TO DAA
- COMPATIBLE WITH EXISTING TELETYPES AND TIME SHARING MODEMS
- ALL DIGITAL MODULATION AND DEMODULATION. NO ADJUSTMENTS REQUIRED.

DC Hayes Associates offers a full range of capabilities for solving your information handling problems. Whether your problem is large or small, we will apply innovative techniques for finding the best solution. Contact us about our products and services.

PRICES:
Assembled 80-103A with 48 hour burn in and 90 day warranty is $279.95

Bare Board with manual is $49.95

D C Hayes associates

H20

P.O. Box 9884 • Atlanta, Georgia 30319 • (404) 231-0574

Heathkit "Program-Ready" Computer Systems Await YOUR COMMANDS!

The 8-Bit 8080

H8

$375.00 Kit Memory must be ordered separately

The Heathkit H8 is designed to provide you with a versatile, efficient computer that's easy and fun to build and use. It features an intelligent front panel with keyboard entry and 9-digit display, a heavy-duty power supply with enough extra capacity for memory and I/O expansion, and an exclusive 50-line fully buffered bus capable of addressing 65K bytes. The CPU board is fully wired and tested and features the 8080A chip, clock, systems controller and full bus buffering. Seven vectored interrupts are available on the bus for quick response to your I/O requests. The mother board has positions for up to 10 plug-in circuit boards for memory and interface cards and complete "program ready" software (BASIC, assembler, editor and debug) is included at no extra cost. Together with its "system designed" peripherals: memory expansion boards, serial and parallel interfaces, the H9 CRT terminal with ASCII 67-key keyboard and the ECP-3801 cassette recorder/player mass storage device, the H8 will provide you with years of computing usefulness and enjoyment.

The 16-Bit LSI-11

H11

$1295.00 Kit

Based on the world-famous DEC LSI-11, the H11 and its peripherals give you all the power and speed you need for total computing versatility. It's one of the few FULL 16-bit computers available to the hobbyist today, and equivalent commercial versions would cost literally thousands of dollars more. The H11 features a fully wired and tested DEC KD11F board that contains the 16-bit LSI-11 CPU, a 4096x16 read/write MOS semiconductor memory, DMA operation, and includes the powerful PDP-11/40 instruction set. Heath/DEC PDP-11 software includes editor, relocatable assembler, link editor, absolute loader, debug, I/O executive and DUMP programs, plus BASIC and FOCAL. The backplane/card guides are fully compatible with all standard LSI-11 accessories. The H11 and its system peripherals: memory expansion modules, serial and parallel interfaces, an extended arithmetic chip, plus the H10 paper tape reader/punch and the H9 CRT terminal give you all the power and versatility you need for personal computing at its very best!

Basic Self-Instruction Course

$29.95 Learn BASIC programming easy and fast with our EC-1100 self-instructional course. Features programmed instruction text, experiments and demonstrations to give you a thorough knowledge of BASIC and programming techniques.

World-Famous DECwriter II

$1495 Deluxe keyboard printing terminal at Heath's sensational low mail order price! Also available: LAXX-KG EIA (RS-232C) Interface with cable and connector, **$65;** LAXX-LM Acoustic Coupler which mounts in LA36 with hardware provided, **$250.00**

FREE!

HEATHKIT CATALOG

The new Winter '78 Edition

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Use coupon for mail-order catalog or bring to store for retail catalog.

do their job to the extent that the work done or the results produced might relate to a new computer. The important things to know are those that are really done, rather than the techniques and rules that "should" be followed. Naturally, the proper procedures should also be considered if different from actual practice. The degree of tolerance and flexibility in the people who will work with the computer and its information are also important factors to know.

Obtaining business understanding might start by considering how information flows now through a business. From where should a computer get its information, and where should it feed its results back into the information flow system? What parts of present business procedures relating to computable functions are flexible enough that you, the owner, would consider changing? Which are fixed, and therefore ones to which a computer would have to adapt?

These normal, basic considerations are only the start. Although statistics on small businesses are not yet available, most of the costs of most older, larger computer applications are due to two factors: exceptions and errors.

EXCEPTIONS Because there are usually several different conditions of information and other computer input, there are several ways, at least in part, that things can be done. Consequently, the system planning and programming costs are several times the cost of doing the "normal" job. For example, in a "simple" vendor invoice processing application, a bill might be received normally, or before the merchandise, or before the agreed billing date, or the "bill" might be a credit, or come when the bank account is too low to pay all bills then due. A bill could be too large or too small, compared to the amount actually due, by a large or small amount for a specified or unspecified reason. Also possible variables in terms of both input and required processing are discount terms, international orders, prepaid orders, COD orders, etc.

ERRORS Although computers are almost perfect (computer errors do have to be anticipated and handled), people are human and don't always do what is reasonable or proper. This problem starts with computer system designers and programmers, the best of whom may cause the device to act very undesirably in unusual conditions. The users or operators of the data processing equipment are certain to do what everyone was sure they would never do, and had instructed them positively not to do. A successful computer application must anticipate errors and plan for solution of the resulting problems.

As a small businessman, your computer system may have fewer exceptions or variables than systems in larger businesses. However, these factors must be considered if your system is to be at all successful. Concerning errors, a universal principle of computer planning is that it is easier and less costly to prevent problems than to fix them.

Another important consideration is people, especially how present employees will relate to what can easily be considered as a threatening, even aggressive, intruder *(The computer is going to take over my job — as soon as it can! PANIC!!).* Bringing a computer into a business is not only bringing a new machine into its operations. A computer is also a tool that often helps people intellectually, or, at least, requires that some people interact with it on an intellectual basis. For this reason, and because of the dramatic effect that a computer can have on a business and its employees' work, bringing a computer into a business is also somewhat like bringing in a new employee.

Proper preparation can greatly in-

crease the productivity of both people and computer. This preparation may include presenting the computer as a tool which enhances the importance of people and frees them for more interesting jobs, rather than an usurper of people's functions and value.

But we're not ready to do that yet. First comes further evaluation of the possible value of a computer to your business and this leads to the decision of whether, where, and how a computer will be a net benefit to your business now.

Some of the preceding ideas may seem negative — to make using a computer harder than many people feel it is. But our intent has been to be realistic — to prepare the prospective user to look at all the considerations and to be able to make a decision after considering all relevant factors.

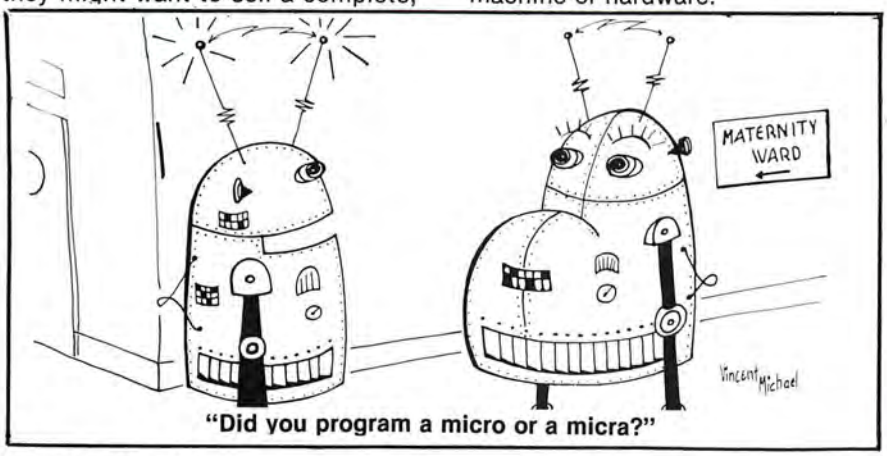
If you have good answers to the preceding questions and considerations, you are well prepared to go ahead and start evaluating actual computing alternatives. But what if you aren't comfortable with your answers to these questions? Then, I propose, you are not ready for a computer at this time. Further, you have defined your desirable degree of personal computing involvement. Hence the following options are available for further progress: 1) Delegate the responsibility for these questions, and therefore, necessarily, also for the management of the computer-related parts of your business, to someone in your organization. 2) Train yourself or obtain basic training. 3) Obtain the needed support from a consultant or other vendor outside your business organization.

Of course, actual conditions may call for a combination of these options.

Computer planning questions needn't be, and probably shouldn't be, answered alone. One place to look for help is to prospective computer system vendors. Pick out some people or organizations; ask them if they might want to sell a complete, operational computer system package to you — on your conditions to meet your specifications. If so, explain to them your situation, ideas, and wishes. Let them tell you what they think is practical for their and other vendors' computers to do and not do. Ask for references who can substantiate actual performance supporting their statements. After a series of increasingly detailed discussions, with both you and the vendor becoming increasingly knowledgeable of the important issues, you should have a good start in choosing the system for specific needs of your business. Alternatively, and equally worthwhile, you may have confidently concluded that a computer would not be a net benefit to your business now.

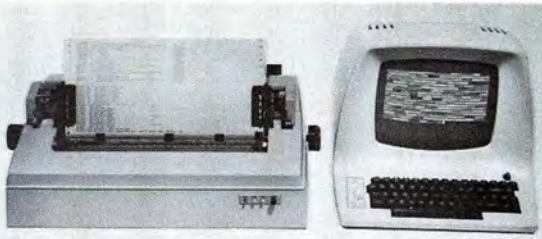
If your chosen approach includes the selection of a consultant, or similar type of assistance, how might that selection be done? There are many ways, and, as a successful small businessman, you are probably well skilled in that art. One particular selection criteria unexpected by many applies to a computing consultant and to an employee to whom computing management is delegated. He or she should be able to help you understand what a computer will do in and to your business, and how and why. Furthermore, he should be able to communicate these ideas on the level of your business, using its terminology, and not only computer terms. The functions of computers really aren't difficult to understand. Your obtaining that understanding, as it applies to your business, should be one of the important results acquired of your computer expert.

If you follow the above guidelines, you should be reasonably well prepared to start looking at specific computing capabilities for your small business. But, as we shall emphasize next month, the product for most small businessmen to look for and to evaluate is the entire computer system service package needed to meet your needs, not just the machine or hardware.



"Did you program a micro or a micra?"

ASYNCHRONOUS AND SYNCHRONOUS



INTERRUPT DRIVEN

SOFTWARE PROGRAMMABLE BAUD RATES

SIX PORT SERIAL I/O

Introducing the AM-300*—an S-100 compatible six port serial I/O board. Designed to enhance the AM-100* 16-Bit microprocessor board set, this I/O is one of the fastest, most efficient, versatile serial ports available for microprocessors supporting time sharing.

SOFTWARE PROGRAMMABLE

Also compatible with 8080 microprocessors utilizing the S-100 bus, it provides six fully programmable RS-232 ports—each independently software programmable to select any of sixteen baud rates up to 19,200 baud. Multi-level, interrupt-driven under program control, each I/O port will accept, independently, data in either asynchronous or synchronous modes. This is accomplished through use of six Western Digital's ASTRO chips (UC-1671B).

WITH MEMORY MANAGEMENT

AMOS* (Alpha Microsystems Operating System) now supports Memory Management utilizing Industrial Micro Systems 16k Static RAM boards. This system allows memory expansion up to 256k bytes providing true multi-user/multi-tasking partitions up to 48k byte for most S-100 bus mainframes.

The AM-300* with 256k bytes memory provides superior handling capabilities for the user's application.

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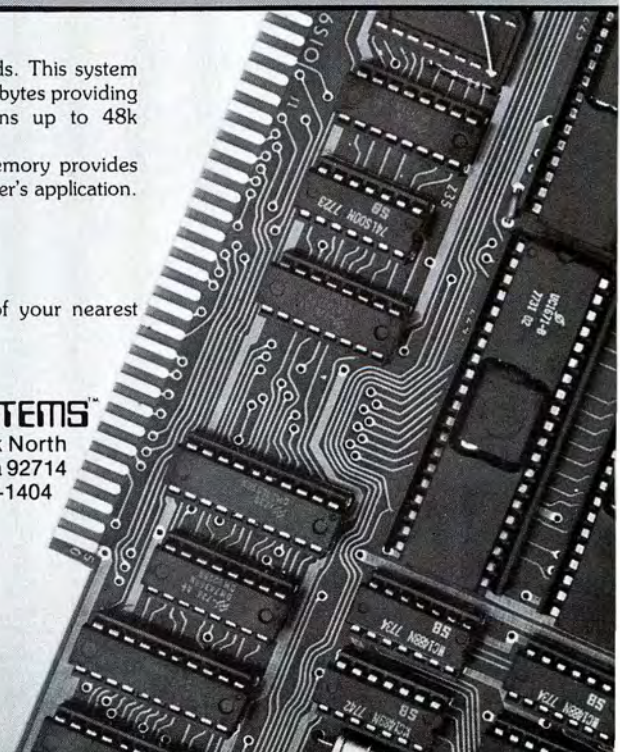

CIRCLE INQUIRY NO. 1

THE JURISPRUDENT COMPUTERIST

Elliott MacLennan, Attorney at Law
Stephen Murtha

SUBCHAPTER S THE TAX HYBRID SMALL BUSINESS CORPORATION

This is the second column in a series of columns dealing with the legal, tax, and tactical considerations which go into choosing the form in which to run your business. The first column dealt with sole proprietorships and partnerships. In this column, we shall discuss a unique form of organization; the Subchapter S corporation (Sub S), which can be very valuable to the entrepreneur.

ADVANTAGE OF ELECTING SUB-CHAPTER S STATUS

The principal income tax advantage of the Sub S corporation is the elimination of the corporate tax, thereby avoiding the "double taxation" of corporate earnings while preserving the traditional legal advantages of operating in the corporate form, i.e., limited liability for owners; free transferability of stock; centralization of management and continuity of life.

PURPOSE

The underlying purpose of the Sub S corporation was to promote "tax neutrality" in the choice of the form of doing business. Query: Does the Congressional selection of the word "neutrality" mean that without this tax armistice, businessmen would be at war with the Internal Revenue Service?

TAX SAVING IDEAS

There are several reasons to elect S to be taxed as a Sub S corporation other than avoidance of the double tax imposed on the standard or Subchapter C corporation. Generally, the Sub S is helpful when a shareholder's income derived from the corporation is either low or non-existent, or inconsistently, extremely high.

Specifically, where the shareholders are in a lower tax bracket than the double-taxed Sub C corporation, the Sub S decreases the tax burden.

The Sub S performs probably its most distinguished and meritorious service in the business "start up" situation. Business losses exceed income, or to be specific, allowable deductions produce a "net operating loss" which can be used to offset other income of the taxpayer. These losses are said to "pass through" to the Sub S shareholder; not so for the shareholder's unlucky shareholder in the Sub C corporation. An analogy to a diode may be helpful here. The loss "pass through" to the Sub S shareholder would be a diode forward-biased and reversed-biased to a Sub C shareholder.

An excellent income splitting device, i.e., shifting income from one family member in a high tax bracket to one in a lower bracket, is possible because the Sub S only taxes the amount of corporate income not previously distributed to the shareholders. Since a shareholder's status is determined on the last day of the corporation's tax year, a gift of stock to a lower bracket family member may be effected. This device requires cautious and thorough planning to avoid Internal Revenue Service attack for prohibited assignment of income.

Where the Sub S corporation's tax year is different from the calendar year, a tax deferral possibility exists. Again, since the undistributed portion of corporate income is not taxes unitl the last day of the corporation tax year, taxpayer-shareholder may consider the following:

Assume a Sub S corporation with a fiscal year ending January 31 of each year. Assume the Sub S has $100,000 of earnings. Assume $50,000 is distributed to taxpayer-shareholder during the calendar year (January 1 to December 31). Taxpayer must report the calendar year income on the first April 15 following the close of the calendar year

THE INFO 2000 BUSINESS SYSTEM

A Complete Data Processing System for Small Businesses

LET'S TALK HARDWARE . . .

Last month INFO 2000 introduced the most capable and cost-effective microcomputer system you can buy for business data processing. This month's advertisement takes a closer look at the hardware which makes up the **INFO 2000 BUSINESS SYSTEM,** while future ads will focus upon the outstanding accounting and word-processing software offered with the system.

MASS STORAGE

The heart of a business system is its mass storage. INFO 2000 uses the PerSci 277 dual diskette drive, whose outstanding performance parameters set it apart from other floppy disk systems.

PRINTERS

Hardcopy devices tend to be expensive, but a high-performance printer is crucial to the success of a business data processing system. INFO 2000 offers both a high-speed line printer and a medium-speed work processing printer; either or both may be configured with the **INFO 2000 BUSINESS SYSTEM.**

The high-speed line printer provides continuous-duty bidirectional printing at 160 characters per second—about 6 times faster than competitive units. This state-of-the-art peripheral prints a full 132-character line, and has an adjustable forms tractor which accomodates all sprocket-feed business forms up to four layers thick, and up to 15 inches wide. The printer generates all 95 ASCII characters including true lower case letters with descenders, and also has a complete graphics capability. (The pictures of the Mona Lisa in the photo shown were actually printed on this unit.)

The medium-speed word processing printer provides print speeds up to 55 cps, and utilizes the latest in daisy-wheel technology to provide typewriter quality output. The unit accepts either carbon or cloth ribbons, quick-change type wheels in a wide variety of fonts, an adjustable forms tractor for sprocket-feed forms, plus conventional platen feed for ordinary letterhead. This printer includes a complete Selectric-style keyboard, and can be used as an auxillary console for the computer system, or can be switched off-line and used as a typewriter.

VIDEO CONSOLE

The selection of a video console is especially important in a business system because of the many hours that you will spend in front of that console. INFO 2000 has tried, tested, and rated them all, and has chosen the very finest video console on the market for its system. This unit incorporates a third-generation microprocessor to provide advanced functions and complete self-test capability. The commercial-quality keyboard includes a full typewriter keyboard, a row of special function keys, and a separate numeric keypad. The video display uses an 8x8 dot matrix character generator (instead of the usual 5x7) to provide a beautifully readable display of all 95 ASCII characters including true lower case letters with descenders—especially important for word processing. Other features include line graphics (for displaying business forms on the screen), dual display intensity, reverse video, and an extra high speed of 19,200 bits per second (instead of the usual 9,600).

CENTRAL PROCESSOR

The processor is a Z80, the fastest and most advanced 8-bit microprocessor available, and is configured with up to 56K of RAM memory (32K standard). The remarkable INFO 2000 universal I/O board combines a complete diskette controller for up to 8 drives, two RS232 serial ports with software-selectable baud rates, three 8-bit parallel ports, and 8K of EPROM on a single printed circuit board. Thus the standard system requires only four boards: CPU board, I/O board, and 2 16K RAM boards.

The professional quality mainframe includes a filtered forced-air cooling system and a heavy-duty constant-voltage (ferroresonant) power supply with twice as much rated capacity as actually needed by the system. The **INFO 2000 BUSINESS SYSTEM** is built around the widely used S-100 bus architecture, providing unlimited flexibility to expand or customize the system with a wide variety of off-the-shelf S-100 modules. You are not locked into the product line of a single manufacturer.

The standard mainframe provides 12 slots in a compact, attractive package; even this provides for a great deal of system growth potential, since the standard 32K system uses only 4 slots! Optional mainframes with 22 slots and with 22 slots plus a complete front panel are also available.

OPERATING SOFTWARE

Standard operating software for your own program development work is the best and most complete available for any microcomputer system, and includes a complete Disk Operating System plus the full library of Technical Design Labs (TDL) software: Super BASIC, Macro Assembler, Text Editing Language, and Word Processor. An extended ANSI FORTRAN IV is available at additional cost, as are the complete accounting and word processing applications packages which will be detailed in future INFO 2000 advertisements.

COST AND DELIVERY

INFO 2000 offers this system as a total ready-to-run package, with all components fully assembled and tested together as a complete system. The price of the basic system is $8,000. This includes a standard 32K processor, dual diskette system, high-speed line printer, video console, plus the disk operating system and complete TDL software package as described. The price also includes all cabinetry and cables, box of diskettes, spare printer ribbon—absolutely everything you need to plug in and run on the first day!

Delivery is 15-30 days after receipt of your order. COD orders are accepted if a 20% deposit accompanies the order, but INFO 2000 extends a liberal $200 discount to retail customers who prepay in full at the time of order. California residents must add 6% sales tax.

Options include the following: Additional 16K RAM, add $400. 22-slot mainframe instead of standard 12-slot, add $150. 22-slot mainframe plus full front panel, add $650. Medium-speed word processing printer instead of high-speed line printer, add $1,100. Both printers, add $3,300. ANSI FORTRAN IV software, add $350.

All components of the system are fully warranted by INFO 2000 for a full 90 days. We have taken every precaution to ensure that you have no surprises and no hassles. Other small business computers are being advertised, but we honestly believe that you cannot buy another system with comparable technical credentials that is priced close to the **INFO 2000 BUSINESS SYSTEM.**

For additional information, circle the indicated number on the reader service card. Or for a faster reply, write us directly. Dealer inquiries are welcomed.

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The difference is value. Take a look at our low-cost microcomputer's heavy duty cabinet. Even with the cover removed, it maintains its rigid structural integrity. But we don't stop there. Quality built Vector Graphic products, from boards and kits to complete systems — such as our Memorite turn-key text editor shown below — beat *all* competitors in mechanical, thermal and electrical design.

Based on an 8080A microprocessor and the S-100 bus structure, Vector Graphic microcomputers are compatible (with the exception of minor I/O patches) with all of the current 8080A software.

If you're designing small business systems, text editors, control equipment, games or even microprocessor development, it will pay you to look into our low cost microcomputers and interface boards, kits or assembled.

Rush me details today.

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Word processing systems for $7,950 — features normally found in systems costing twice as much.

CIRCLE INQUIRY NO. 62

when that income was earned. If taxpayer waits until after the close of the calendar year and pays out the undistributed $50,000 portion of income between January 1 and January 31, taxpayer will not have to report this income until April 15 of the next year, i.e., fourteen and one half months later. The economic rationale is this: If taxpayer can defer payment of tax for one year, then the amount of tax that would have been paid except for the deferred amounts to an interest-free loan to taxpayer for the year deferred.

Shifting to the other end of the income spectrum, a Sub S can help taxpayer in the following manner. Many Sub C taxpayer-shareholders tire of wrangling with the Internal Revenue Service over what is "reasonable compensation" in the form of salary and bonuses paid to them from their corporation. If, as the shareholder argues, compensation is reasonable, then generally the maximum tax imposed is fifty percent. The Internal Revenue Service, if successful in contending that the compensation is unreasonable, may tax the unreasonable portion up to seventy percent. The Internal Revenue Service rationale being that the compensation by not being reasonable must be a disguised distribution of corporate earnings and profits, i.e., disguised dividends.

Lastly, if taxpayer elects Sub S status because of expected loss pass through from start up losses, and surprise — the venture is quickly producing a profit beyond taxpayer's requirements for personal spending income, taxpayer may want to terminate the Sub S election to reduce the tax burden. Caveat: Termination of Sub S status must be planned carefully and once accomplished, cannot be subsequently elected, generally for five years.

OPERATION

In general, income is reported on the shareholder's individual tax returns directly. The corporation files a tax return, a form 1120S each year, even though it pays no tax. Certain tax preference items such as capital gains, accelerated depreciation, etc. receive special treatment, unfavorable from the taxpayer's point of view.

There are seven basic requirements set out in the Internal Revenue Code which must be met in order to elect Subchapter S status. The word elect is of critical importance here. All of the shareholders must elect to be taxed under Subchapter S provisions. If any one or more shareholders do not elect, or if one of the shareholders terminates his election, then the corporation loses its privilege to be taxed as a Sub S corporation.

The seven requirements for eligibility of this method of taxation are as follows:

1) The corporation must be a domestic corporation. In addition, it may not be a member of an affiliated group eligible to file a consolidated return with any other corporation.
2) It may not have more than ten shareholders during the first five years under election and no more than fifteen shareholders thereafter. The only exception to this rule of ten during the first five years is the addition of new shareholders who inherited their shares from a deceased shareholder. In this case, the number may go up to fifteen during the first five years. A husband and wife who hold shares as tenants in the entirety, tenants in common, joint tenancy, or as community property will be counted as only one shareholder in applying this rule.
3) All shareholders must be indi-

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Have you considered the Central Data 16K RAM board? If you haven't, you should. We've combined quality engineering and low prices to come up with a memory board you'll like. Take a look at our features and find out for yourself.

- completely assembled, tested and burned in
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You can purchase a 16K RAM board with all these features for only $289. The cost of adding 16K to your present Central Data 16K board is $200. A 32K RAM board, assembled, tested and burned-in, is only $475.

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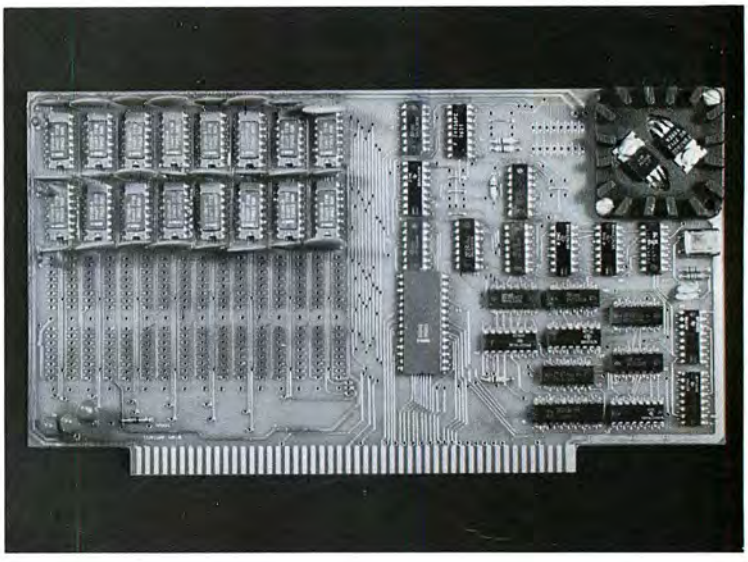

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viduals, estates of decedent shareholders, or certain trusts. A corporation cannot elect Subchapter S treatment if another corporation, partnership, or non qualified trust has stock in that corporation.

4) A non-resident alien may not be a shareholder.
5) The corporation may not have more than one class of stock.
6) The corporation may not get more than eighty percent of its gross receipts from sources outside the United States.
7) The corporation may not get more than twenty percent of its gross receipts from interest, dividends, rents, royalties, annuities, and gains from sales or exchanges of securities. (This is called "passive income.")

The first five of these requirements must be met before the corporation can make a valid election for a given tax year. Failure to meet *any* of the requirements will automatically terminate an otherwise valid election for the tax year in which the condition is not met. Remember, if the Subchapter S election is terminated, either voluntarily or involuntarily, then the corporation must wait for five years until it can re-elect this tax treatment under most situations.

There are also several advantages which both Subchapter S and Subchapter C corporations have over sole proprietorships and partnerships. These will be examined in the next two columns dealing with Subchapter C corporations.

The Subchapter S corporation is one of the forms of business often used by new or extremely successful business ventures. It can offer many of the advantages of the corporate, partnership, and sole proprietorship form of business in the form of a hybrid possessing most of the desirable aspects of all forms.

A thorough examination of the company's business plan and future growth pattern are essential prerequisites to consider prior to electing this unique form of doing business. Lastly, it should be pointed out that the Subchapter S provisions exist only with respect to Federal, not State, income taxation.

The material presented in this article is intended for the reader's general information. The authors request that the reader consult professional advisors prior to applying this material to his or her specific situation.

The High Performance Floppy Disk System That's Not High Priced

Micromation's MACRO DISK is a complete, high performance floppy disk system—yet it's economical.

Fast Per-Sci Drive

MACRO DISK uses the unique Per-Sci dual drive to give you the fastest, most reliable system available. This unique drive features a fast voice coil positioner and automatic electronic diskette handling. It's a field-tested design that's proven its reliability and superiority in years of operation. And its a full-sized dual drive—you have on-line mass storage of over 500K Bytes, and you can copy diskettes to provide essential system backup.

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The Micromation disk controller features full IBM 3740 formating—so you can interchange disks with the rest of the world. There's even a serial I/O port on the controller board to make it easy to bring the system up. Just connect your terminal to the controller's serial interface, install in any 16K S-100 system, jump to the on-board PROM bootstrap—and you're up and running without any patching.

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MACRO DISK is fully assembled and tested. And it's complete—including aluminum enclosure, cables, power supply, and fan. Everything you need to bring big system performance to your S-100 computer.

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For program development select the optional Micromation version of CP/M, the most powerful floppy disk operating system available for microcomputers. And there's BASIC. A complete disk BASIC featuring: versatile file access; string processing; and both numeric and string arrays.

Under $2,000 Systems

The fast Per-Sci drive, the IBM compatible controller, and the powerful CP/M software make MACRO DISK a high performance system. And since MACRO DISK uses proven, standard components, there's no long wait for delivery. Systems are available in less than four weeks from receipt of your order. But the best news is the price.

MACRO DISK dual Disk system	**$1,895.**
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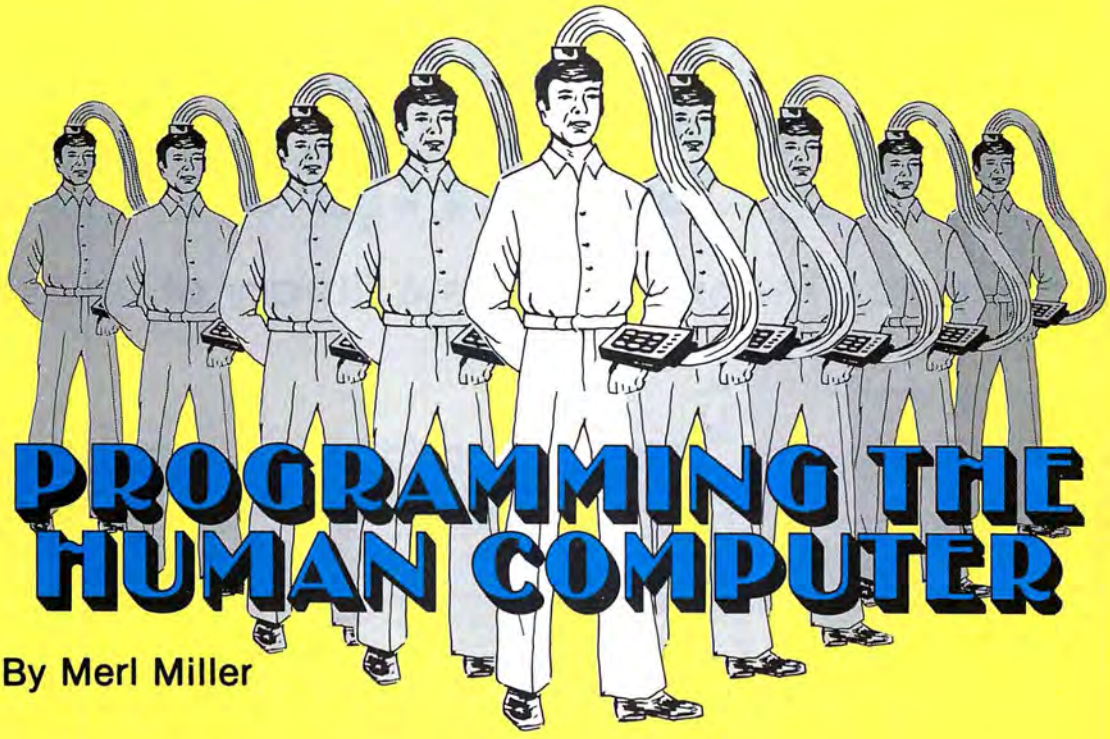
Ask about MACRO DISK at your computer store, or write or call for additional details. Micromation Inc., 524 Union, San Francisco, Ca. 94133, (415) 398-0289.



PROGRAMMING THE HUMAN COMPUTER

By Merl Miller

HOW TO GET THE MOST OUT OF A COMPUTER CONVENTION

Attending a computer convention can be both fun and rewarding, but it can also be a waste of time. What you get out of it is in many ways dependent on how well organized you are. The basis of this organization is a good plan. To get a good start, begin developing your plan at least a month in advance.

The first thing to do is *preregister*. I can't emphasize this enough. Usually, you will save $2.00 or $3.00 by preregistering, but the savings in time and irritation will be worth many times this amount. You might also ask about groups.

The second thing to do is order a rubber stamp or a packet of mailing labels. This will save you the trouble of writing your name down on 200 mailing lists. It also offers you some assurance that the exhibitor will be able to decipher your name.

Start your plan by deciding whom you want to see, what interests you and why. You will find a list of exhibitors in your preregistration kit. If you need equipment, books, or software there will be plenty of manufacturers, electronic equipment suppliers and computer stores from which to choose. Determine how much you can afford and what you want. Most exhibitors will accept cash, check or credit card and give a discount, so go prepared to buy some things. As a general rule count on looking at the item at the manufacturer's booth and buying it at the dealer's booth. Most manufacturers do not want to compete with their dealers, so you will probably get a better price from a dealer. Narrow the list of exhibitors down into two groups: those you really want to see (the key group) and all the rest (the other group). Once you have done this you are ready to consider the sessions.

Read the title and the description of every session listed and ask yourself these two questions: What can I learn from this and what good will it do me? Make a list of the sessions you think might teach you something and then go through it again. Ask yourself the same two questions. You should be able to narrow the list down to a workable manner. By the way, be sure to take a notepad, a pencil and a tape recorder. (You can tape record any session providing you don't make a copy for *anyone* else.)

When you have decided what you would like to see, you are ready to lay out your time. Make up your mind right at the start that you are going to allow enough time. The minimum is about six hours. You will want to divide your time at about ⅓ at sessions and ⅔ at exhibits. You'll need about five minutes at key booths and about two minutes at other booths. Most sessions will be about ½ hour. As an example, assume you have six hours. This means you will be able to attend four sessions (6 hours × ⅓ = 2 = 4 half-hour sessions). You will have four hours to spend in the exhibits. If you spend 50% of your time at those key exhibits (120 minutes ÷ 5 minutes) and 50% of your time at other exhibits (120 minutes ÷ 2 minutes), you can see 24 key and 60 other. This is less than half of the usual convention.

A much better way of doing this is to decide you are going to spend as much time as necessary. As an example, let's assume there are 200 booths. The first thing to do is divide the number of booths by 3.5; this will give you the number of key booths you can see. Multiply this by five minutes:

200 ÷ 3.5 = 57 key
× 5 min. ÷ 60 = 4.75 hrs.

If you are going to spend 4 hours and 45 minutes at key booths then you are going to spend 4 hours and 45 minutes at the other booths:

4 hrs. 45 min. ÷ 2 min. = 143 other

If you are spending 9½ hours total and spend 5 hours in sessions, or 10 sessions:

9.5 hrs. ÷ .666 = 14.26

Now if you compare this to your list of sessions you want to attend and exhibits you want to see, you should be able to figure out the ideal time you want to spend. Add in a little time for lunch, chatting with friends, etc., and don't forget time to sit down to rest your feet. Convention-going is exhausting.

The conclusion you should draw from this is that it takes more than one day. Most of the personal computing conventions are on the weekend, so you should have the time. Use it! If you can, you should attend all three days. There are advantages and disadvantages of attending at various times. The best time to buy something is the first day and the

Puzzled About Computers?

Data Dynamics Technology has a library of answers . . .

1 **An Introduction to Microcomputers: Volume 0, The Beginner's Book**
By Adam Osborne. 226 pages, $7.50
This book has been written for readers who know nothing about computers, and it has been written for two audiences: 1) For those of you who have a real interest in learning how to use computers. 2) For everyone else — who must live with computers, and need to know a little about them. For those of you who have a real interest in learning how to use computers, this is the first in a series of books. After reading this book you will be ready to move on to "Volume 1 — Basic Concepts," which gives you the information you will need in order to use computers.
Order No. OSB6001, paper.

2 **An Introduction to Microcomputers: Volume 1, Basic Concepts**
By Adam Osborne. 287 pages, $7.50
This book covers the hardware and software concepts required for the intermediate technician and hobbyist's needs.
Order No. OSB2001, paper.

3 **An Introduction to Microcomputers: Volume II, Some Real Products**
By Adam Osborne. 868 pages, $15.00
As the second volume in a two-volume set, the purpose of this book is to describe some real products which implement the general concepts covered in Volume I. In this book, devices of the 8080A, MC6800, Z80, and MCS6500 microcomputers are described in approximately the detail we believe to be necessary.
Order No. OSB3001, paper.

4 **Build Your Own Working Robot**
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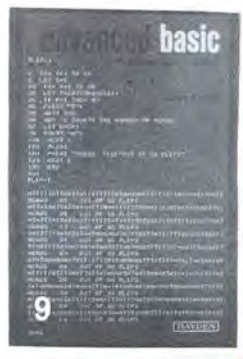

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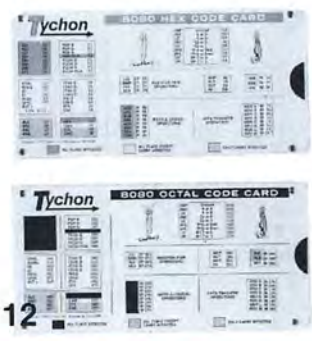

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DATE: MARCH 17, 18, 19, 1978

PLACE: PASADENA CONFERENCE CENTER

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MICRO BUSINESS '78™ will provide a series of marketing forums and exhibits to introduce the small independent businessman to the new low-cost, high-power business microcomputer that will reduce his company's costs, place him in a more flexible marketplace and provide timely data information.

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- The Mainframe Companies & The Small Computer
- The Small Business Computer Company
- Computer Stores and the Small Business System
- Retail Mass Marketing of Microcomputers

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Ed Tavetian

best time to see something is the last day. Reasons for this are: exhibitors run out of both customers and goods by the last day. Many conventions close at 7:00 Sunday and from about 3:00 on the convention hall is very quiet. If you want to miss the crowds, go on the last day, but be prepared to place orders rather than buy things on the spot.

Once you have decided what you are going to see and what days you are going, you are ready to make a checklist and a schedule. To make a checklist start by grouping your key exhibitors by what they do, for instance:

A. Magazine Publishers
   1. INTERFACE AGE
   2. Creative Computing
   3. Kilobaud
B. Book Publishers
   1. dilithium Press
   2. Hayden
   3. Osborne & Associates
C. Hardware
   1. E&L Instruments
   2. MITS
   3. Ohio Scientific
D. Software
   1. Meca
   2. Byte Shop
   3. Technical Design Labs

(Please understand that this is just an example of part of a possible list, it does not mean I am endorsing any of these companies.) Put your checklist, by groups, on 3x5 cards. When you visit a book, check it off. Using the checklist in conjunction with your schedule should keep you from missing someone you wanted to see.

Your schedule should be laid out on both a time-and-place basis. You will need a floor plan to do it. You may not get the floor plan until you arrive, but you can leave space on your schedule. Here is a sample schedule:

Friday 6:00-9:00
6:00-6:15
Registration
6:15-7:00
Booths 185-200
Key: 185, 188, 193, 198, 200
7:00
Session-2
7:30
Session-3
8:00-9:00
Booths 160-185
Key: 160, 162, 173

Make a schedule like this for each day you are going to attend. Once you have your schedule and checklist complete, you are ready to attend the convention.

Here are a few things to keep in mind when you get to the convention. While you are standing in the preregistration line, look around the area and try to figure out where are the lunch counter, restrooms, etc. Pick up a floor plan and organize your checklist and schedule according to the floor plan. Also, try to find out who is giving away bags. Follow your checklist and schedule and check things off as you see them. It is usually a good idea to pick up a bag immediately, but stick with your schedule. Don't start seeing the exhibits at the booth where you pick up the bag. Try to arrive at sessions 5-10 minutes early so that you can organize your thoughts. If you are going to eat lunch, go at 11:00 or 1:00, so you won't get caught in the crunch.

If you follow the suggestions I have outlined you should gain a lot from the convention. However, there is a better way. Use my method as a base and develop your own. Regardless of what plan you use, it is better than no plan.

Next month, a look at what courses are offered around the country.

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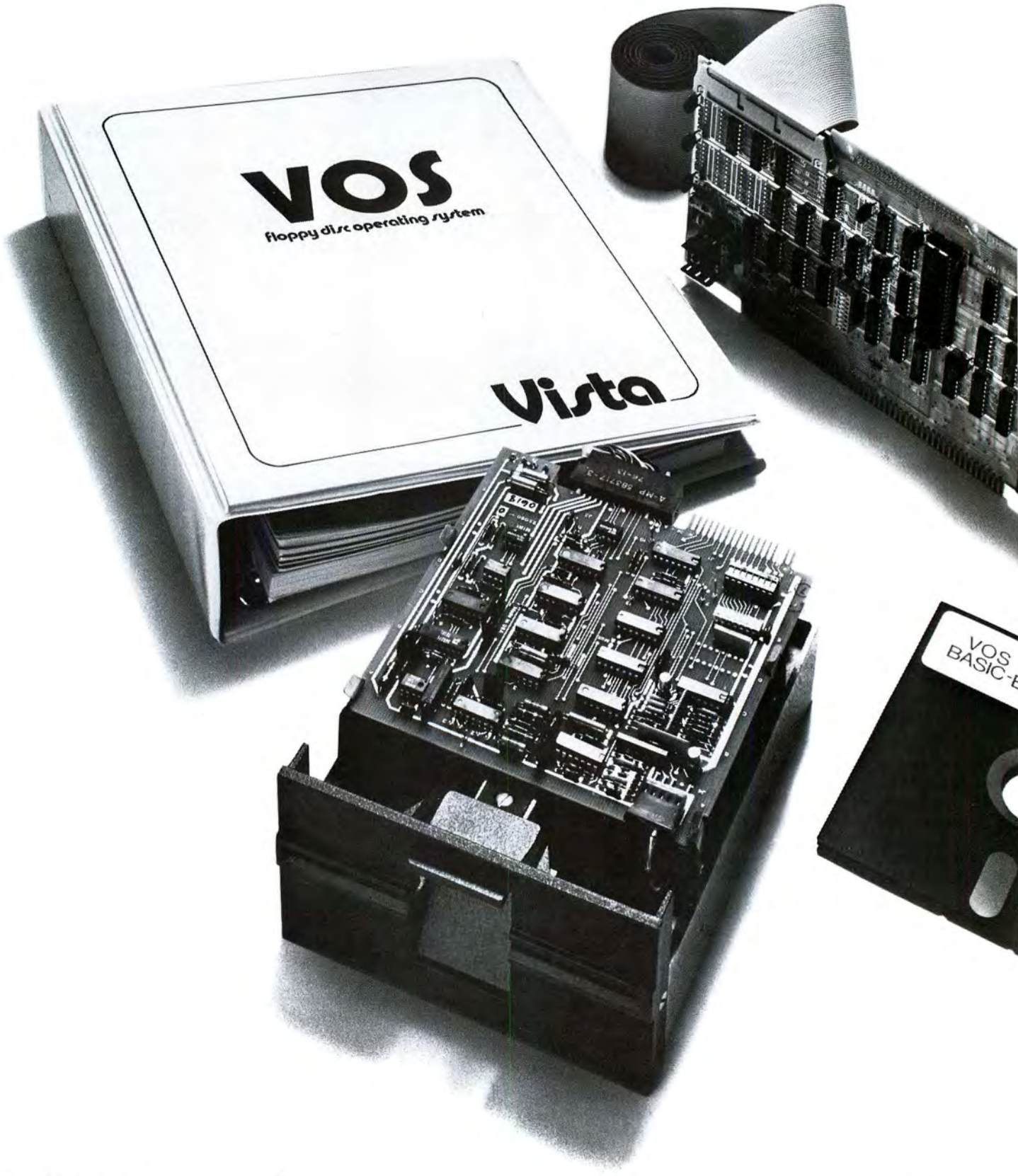

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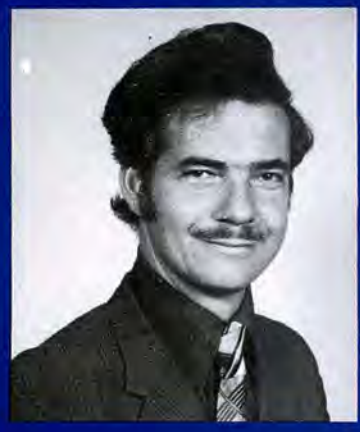
. . . FROM THE FOUNTAINHEAD

By Adam Osborne



Individual customers and computer stores must immediately stop paying for hardware or software products in advance of product delivery. You should only pay with your order when dealing with companies that have an established record of filling the order immediately. Paying for something months in advance of receiving it (if you ever receive it) is not only unfair to the buyer, it is encouraging manufacturers and stores to dig for themselves a financial hole out of which they cannot climb.

I have recently received a large number of complaints both from individuals and stores regarding hardware and software that was delivered many months after payment was made, or that has never been delivered. I could name some of the manufacturers and stores guilty of these crimes, but I will not do so, since merely listing the names of these outfits in this column could conceivably drive them into bankruptcy — which would certainly not benefit the hundreds or thousands of people with outstanding orders.

It is very important that *everyone* stop paying months in advance for products. This practice does no one any good. For manufacturers, this is how it works: you pay three months in advance for something you wish to buy. The manufacturer needs to buy supplies in order to build your product; but the manufacturer who forces you to pay three months in advance does not pay his bills until three months after taking delivery. Thus he gains a six-month cash float on everything he is building. This is the money he uses in order to build the products he is selling. This policy is extremely dangerous, because it takes just one slip and the company can go bankrupt. Suppose, for example, a manufacturer has been advertising a new floppy disc-based system that he cannot make work. By the time he discovers that he cannot make the floppy disc-based system work, he has spent all of the money that people paid to buy the system and he has incurred debts buying the parts needed to build the system. Now that the system does not work, all of that money is lost, and that could be enough to drive the company into bankruptcy. There is no need for this type of financial fly-by-night operation; it is simply the product of greedy company owners. Plenty of investment money is available today which could be used, instead of customers' cash, in order to design and build new products. The problem is that no one will give you investment money without buying a part of your company. And the present crop of manufacturers are simply too greedy and arrogant to give up anything. We must force them to operate their businesses legitimately, or the whole industry is going to acquire a lousy reputation. And the way we force them to operate legitimately is by no longer paying in advance for a product that may never be shipped.

I was recently in Toronto at the Canadian Computer Show. I had a chance to talk with people running the three major computer stores in Toronto. These three stores are the Computer Place, the First Canadian Computer Store and the Computer Mart.

The Computer Place is run by Steve Pumple, Murry Des Noyer and Karen Klein. There are approximately 18 people working at the Computer Place, which sells ten to fifteen computer systems a month. About half of these systems go to hobbyists, while the other half go to industries and schools. The Computer Place offers in-house service plus programming.

The First Canadian Computer Store is run by John Crawford and Ian Hutchinson, two gentlemen with a very substantial computer industry background. The First Canadian Computer Store employs eight people (and happened to have Miss Canada at their booth); they sell three hardware configurations as packages.

The Competor 1 is a small business system. The Competor 2 is a retail control system for stores, or other retail outlets. The Competor 3 is a word-processing system. The First Canadian Computer Store is shipping 20 to 30 systems a month, mostly to industrial customers.

The Computer Mart is run by Spence Howard and Tilo Blankenfeldt, who also have significant data processing and computer hardware backgrounds. The Computer Mart ships approximately twelve systems a month with a mix of hobbyists and businesses as customers. They have three full-time employees and five part-time employees.

What is interesting about all three Toronto computer stores is that by U.S.A. standards they are doing a very substantial business. A computer store that ships ten systems a month in the U.S.A. is considered to be doing quite well. I believe that the high volumes achieved by Canadian computer stores largely result from the far less sophisticated customer base that they are serving. Canadians are more likely to take a chance on a small computer-based system because they have a smaller

Branched to Page 52

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F1

Vectored from Page 14

Dear Editor:

I am most interested in research information you have pertaining to the classroom use of electronic training modules or systems to teach solid state electronics. Research evaluating the teaching systems and comparing them to one another would be most desirable.

Any information covering various types of electronic hardware used in relation to semiconductor teaching aids would also be useful. Research showing a *need* for teaching solid state electronics in secondary schools and junior-senior college would be beneficial.

This material will be used in a study for updating school curriculum in relation to new and changing trends in electronics.

A. Austin
Electronics Instructor
L.A. Unified Schools
17829 Sybrandy Ave.
Cerritos, CA 90701

We are publishing Mr. Austin's address to facilitate his quest for information. Readers: we would also be interested in publishing articles on this theme. Editor

Dear Editor:

Now that you have been officially appointed publisher of robot stories (see KILOBAUD, Sept. 1977, page 20, in response to a letter from Bert Thiel), I hope you will do a complete article on the Century I robot and I hope you will provide us with many more robot articles in future issues.

I like your idea of having each issue cover one particular topic, Bionics, Robots, Astronomy, etc., and I hope you will repeat all the subjects in future issues. It is nice to be able to pick up one magazine and have a lot of information in it rather than a little in many magazines.

Lloyd G. Armstrong
Pueblo, CO 81005

We'll be featuring Robotics Special II in the April issue. Watch for it. A year shows a growth in this new technology. —Editor

Dear Editor:

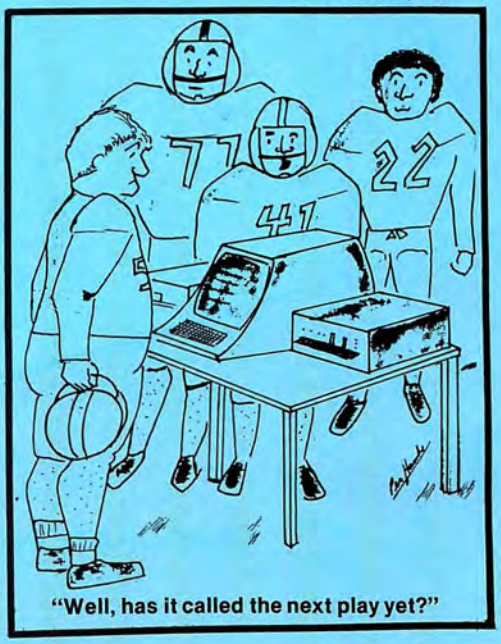
Normally I don't write letters to editors. But as a common sense engineering type (as opposed to being a cloistered, ivy tower university nit-picking engineering type) the malignment and misinformation being spread about the ALTAIR/S-100 bus structure needs, I feel, to be publicly commented upon.

Firstly, granted the ALTAIR/S-100 bus may not be the world's best design (if there really is such a thing) in that some bus signals should not have been placed next to others on the bus. But just like the bumble bee, which according to aerodynamic engineering theory just can't fly, but in fact does fly quite nicely, the ALTAIR/S-100 bus also works quite nicely. I suspect that a lot of the early problems experienced on the ALTAIR 8800 systems were due to the "speggetti mess" (sic) of 100 wires running from the system backplane to the programmer's front panel. That is, some of the bus signals which really shouldn't be next to each other were forced into being close together in the bundle of wires. I suspect that if MITS had designed two 50 or one 100 conductor flat ribbon cable to run between the backplane and the programmer's front panel rather than the 100 wire *"speggetti mess,"* most of the problems traced to the backplane bus would never have appeared. Of course there are also better ways to terminate a bus than just letting it stop at the end of the backplane. That is, some sort of bus termination either active or passive, can do wonders with a glitchy bus. Indeed, the technique of properly terminating a bus is widely used in commercial maxi, midi, mini, and microcomputer systems. After all it is just common sense to terminate a signal carrying line into a fixed known impedance to prevent ringing, pick up and radiation of unwanted signals (cross talk). Therefore, while properly terminating a bus is not a cure all, it is good preventive medicine not to mention a sound engineering practice, which several companies have come to reality (i.e. Godbout, Thinker Toys, etc.).

Secondly, if you decide to go with a system based on the ALTAIR/S-100 bus, you will have a large multivendor environment for your system's components rather than being locked into a manufacturer's product's bus structure which is not ALTAIR/S-100 bus compatible (this remark is aimed specifically at Heathkit and their remarks made in their article which appeared in INTERFACE AGE of August, 1977). Granted the ALTAIR/S-100 bus is not the only bus structure possible, but it is a very viable one for 8-bit microcomputers (gee, wonder why no one has offered a board for the 6800 or 6502 MPU for the ALTAIR/S-100 bus? The market is potentially there.) And one of the few bus layouts that allows adding signals to it (there are sixteen lines uncommitted on the ALTAIR/S-100 backplane). Which means that if you want to add a parity bit to a memory board you have a spare line on the bus to accommodate it. This is something that very few other bus layouts on the market allow.

In closing the ALTAIR/S-100 bus may not be the best possible design (if there really is such a thing as "best design", I personally doubt it), but it does work, and works well, allows signals to be added, is commercially viable (i.e. people are buying it, as evidenced by the large number of ALTAIR/S-100 bus systems and components available from many vendors). The hobby, small system process control, and small business end users would be very very fortunate if the 16-bit microcomputer chips were to end up in as widely an accepted bus structure on the open, freely (not many of those left) competitive market.

Don Walters
Ann Arbor, MI



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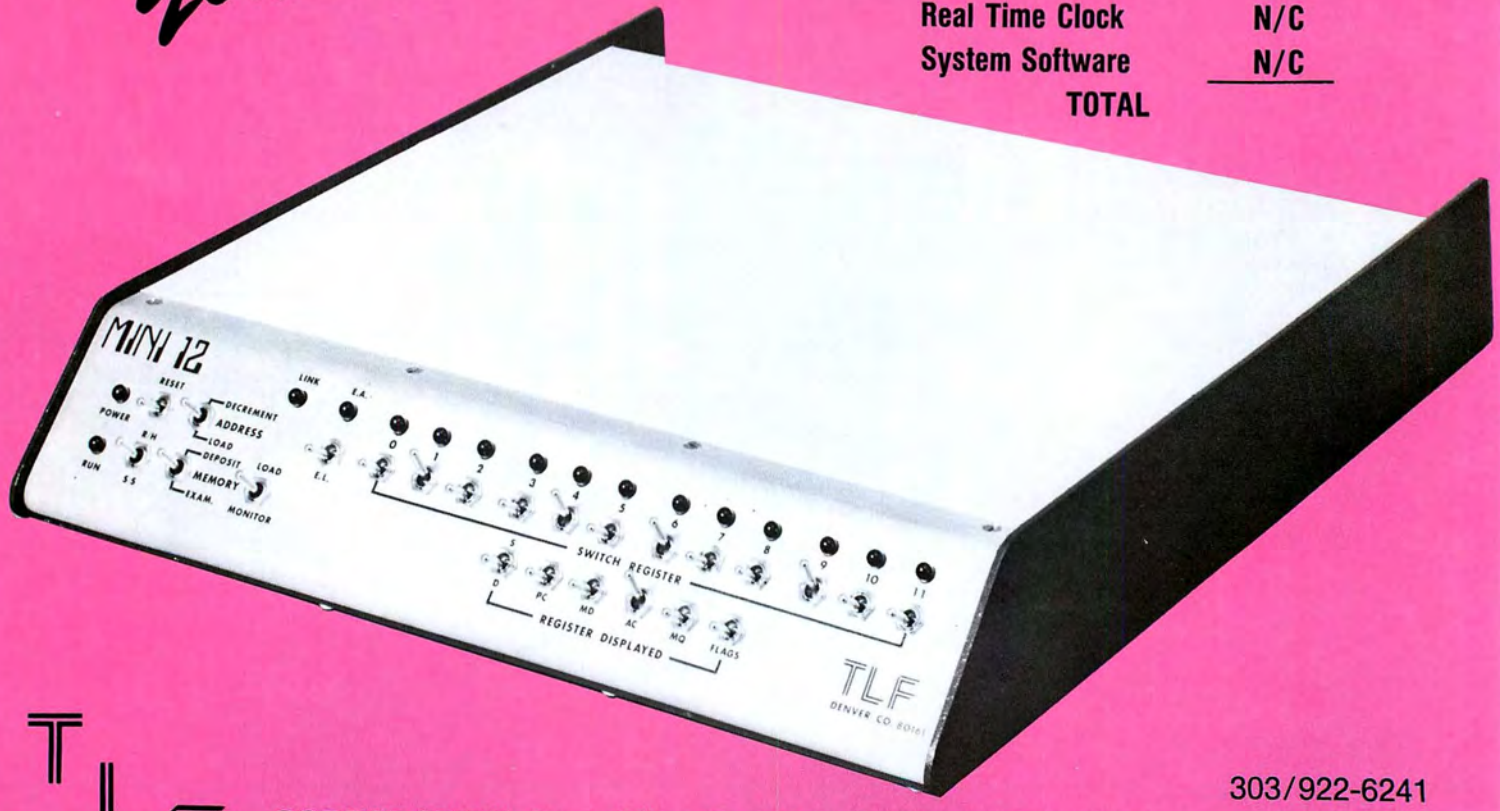
System Software	N/C
TOTAL	



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SENSE LINE

By Sol Libes
President, ACG-NJ

In May, the ACG-NJ (Amateur Computer Group-New Jersey) will celebrate its 3rd birthday and begin its 4th year as a computer hobbyist club. With over 800 members, it ranks as the 3rd largest computer club in the country (the two larger clubs being the SCCS and Homebrew Computer Club). In fact, it may rank as the largest single club in the country, since the SCCS is really an organization of chapters and the Homebrew group is not a formal organization.

Further, the ACG-NJ is the second oldest club, being preceeded only by the Homebrew club. It is interesting to see how a large and successful club was born and how it grew and developed into the leading and pioneering organization that it is today.

I really never intended to start a club. I am a teacher of electronics and computer programming at a community college in New Jersey. My students and I had been involved in a number of digital and computer projects in the early 1970's and I also developed some friendships with home experimenters outside of school. We ran into difficulties trying to get an 8080 system up and running and sought help from other experimenters. The IC manufacturers were very unwilling to help us hobbyists. Therefore, in May of 1975 I decided to hold an informal gathering of computer hobbyists. I sent out notices to all the schools in NJ, to amateur radio clubs and to the few hobbyists I was aware of.

Much to my surprise, 30 people showed up for the meeting. We all introduced ourselves and discussed what we were into. We all recognized that mutual help was the key to getting a home computer system running and that a club would be very beneficial to formalize this activity. The attendees therefore decided, at that first meeting, to hold regular monthly meetings and to publish a small newsletter. In this way members would know who was doing what and could get in touch with other members for mutual help. This concept has been the guiding principle of our club — communications and mutual help.

The members decided to levy a $2/year membership fee to cover the cost of publishing and mailing the newsletter. I was elected "Acting President".

The first meetings were informal, with members showing off their projects and systems or giving short talks and hardware and software. By the end of 1975 the club had grown to 140 members, with as many as 100 people at a meeting. The meetings grew more formal, because of their size. We enlisted the sponsorship of several of the colleges in the state. As sponsors, they provided meeting space and liability insurance coverage under their policies. Generally, the schools did this at no charge, as a community service. Naturally, the schools derived considerable publicity from this sponsorship.

At the end of 1975 we published a Membership Directory. It listed the 144 club members and their equipment. In this way any club member knew who to get in touch with regarding particular equipment and applications. We published another directory in early 1977 (listing 450 members) and expect to publish our third directory soon (listing about 800 members). As far as I know, we are the only club that publishes a

membership directory. Our mailing list is not available to commercial interests. Because of one problem we have encountered, we have decided to omit street addresses from the next directory.

In the spring of 1976, we decided to hold a full-day Computer Festival, which was the first personal computer exhibition held in this country. We held it on the campus of one of the New Jersey State Colleges. We had 42 exhibitors, 30 speakers, an outdoor flea market and about 1500 attendees. Just imagine our surprise at the success we met with. Naturally, we repeated the event in 1977 (for 2 days) with 4,500 in attendance.

We will again hold the festival on April 22-23. This time we expect 6-10,000 attendance and we will have an outdoor flea market area covering five acres. We call it the Trenton Computer Festival, since it is held on the campus of Trenton State College.

In late 1975 we decided to form User Groups (UG). This was necessary because our regular monthly meetings were too large to meet the more personal needs of many members. We initially formed 8080/Z80 and 6800/6502 UGs. This has now been expanded to include an 1802 UG. The UG meetings are held monthly and are designed to meet the needs of users of particular systems. First of all these meetings are smaller with typical attendance of 20-60 people. Here, members bring in systems for hardware or software troubleshooting. Each meeting has a UG coordinator. He runs the meeting on an informal basis, but sees to it that all members who need help get it, either from himself or from others at the meeting. So that at a typical meeting you will see one room with cliques gathered round pieces of equipment debugging a hardware or software problem and in another room a tutorial seminar.

In addition to the 8080/Z80, 6800/6502 and 1802 UGs, which meet monthly, we also have UGs for SOL, POLY-88 and CPM disc users. These groups have coordinators, but at present do not meet regularly.

We started running tutorial sessions in mid-1976. We are presently running tutorial sessions on 8080, 6800, 6502 and 1802 systems assembly level programming. Also, from time to time we hold sessions on "how to get started in home computing". We do not have sessions on BASIC since several of the schools offer these courses.

Also, early in 1976 we founded software libraries, with software librarians. We presently have four such libraries; 8080/Z80, 6800/6502, 1802 and CPM. Software is maintained in these libraries on either paper or cassette tape or disc. A member may borrow a paper tape from the library or he can have a cassette tape or disc recorded. There is no charge for these services.

In late 1976, with over 300 members in the club, we decided that the time had come to formalize it. We therefore wrote a constitution and incorporated, as a non-profit educational organization. We elected officers (I was finally elected President) and a board of directors, which serve for a 2-year term.

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FOUNTAINHEAD

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awareness of I.B.M. and other big guns. Many products which will not sell in the U.S.A. computer stores because of their poor reputation sell quite briskly in Canadian computer stores.

All three Toronto computer stores complained bitterly about slow deliveries on hardware and software. O.K., guys, it is your own fault. Stop paying for goods months in advance of delivery. If a company takes your money and does not ship at once, and if you fall for the same play again, you are a slow learner.

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QWERTY IS OBSOLETE

By Sid Owen

The venerable typewriter keyboard has remained virtually unchanged since it was first produced nearly 100 years ago. This was truly an inspired design. Even the introduction of electric typewriters did not allow significant improvement on the basic keyboard. Modern electronics, however, has recently permitted a completely new design that obsoletes the familiar old keyboard, colloquially called Qwerty for the first six letters in the upper row. This article discusses the features and describes how to build the new keyboard.

Many millions of typewriter, teletype and other keyboards were built over the years and the standard keyboard became essential to business and communication. There were, however, several limitations inherent in its mechanical design. For example: 1) The typewriter itself is a large machine that must sit directly in front of you, occupying valuable desk space and obstructing your view. It is heavy and awkward to move when not in use. 2) To type, you must sit erect with both hands poised in an unnatural position for long periods of time. 3) Each printing character and machine control is assigned to a single key, with very little logic to the key location. Consequently, learning and maintaining typing skill takes much time and effort.

Now that home computers are becoming a way of life, many hobbyists are buying keyboards and experiencing all of the above problems, frequently for the first time.

There is a better way! A radically new keyboard, called the Writehander* has been designed which solves all these problems. It was originally conceived and developed for physically handicapped people, but there is no reason why all cannot enjoy its advantages. You can build it yourself from the information supplied in this article, or you can buy it completely assembled and tested directly from the NewO Company.

The front cover photo shows a close up of the details of the Writehander™ and Photo 1 shows it in use. As you can see, it is used by the right hand only, leaving the left hand free to hold papers or the phone, etc. The small hemisphere may be placed anywhere on your desk or even in your lap while sitting in an easy chair. You can relax while using the Writehander™. The weight of the forearm can rest on your desk and the weight of your hand will naturally rest on the hemisphere since each finger never moves from its single key. Only the thumb changes position. The four thumb positions are: Capital letters, Lower case letters, Numbers and symbols, and Control characters. In each position the thumb is rocked forward or backward to close one of two switches. By using various combinations of fingers and thumb, the Writehander™ generates the entire 128 characters of the ASCII code.

The electrical interface is ASCII code on seven parallel lines, fixed parity on the eighth, Strobe, Acknowledge, power, and ground.

This configuration does not require a computer in order to operate a terminal. While the Writehander™ is an ideal keyboard for computers, terminals such as the Diablo™, Teletype™, modified Selectric™, or video monitor that accept 7-bit parallel ASCII signals can be

*Writehander (Pat. Pend.) is a registered trademark of The NewO Company, 246 Walter Hays Dr., Palo Alto, California.

PHOTO 1. Typing with the Writehander™ is natural and relaxed.

directly connected to the Writehander™. Provision for 5V at 200 ma. is the only modification sometimes required. This also has provisions to regulate higher voltages down to 5V.

Learning to type with the Writehander™ is surprisingly easy, partly because the finger keys correspond directly to the lower four bits of the very logical ASCII code. As can be seen on the chart of Figure 1, the fingers select the character to be typed, while the thumb determines if it is to be lower case, upper case, control or numeral. Numerals, incidentally, are selected by the fingers in binary: i.e. the keys have values of 1, 2, 4 and 8; corresponding to the index, middle, ring and little fingers respectively. Letters are also in a binary sequence, with the result that the fingers correspond to A, B, D, and H.

The Writehander™ is analogous to some musical instruments that require pressing several keys to select a particular note, but it is much easier since the fingers never move from their single key; they simply press or relax as required by the particular character, and you use only one hand.

Figure 2 shows a circuit to convert key closures to ASCII code. All switches are connected to one of two debounce chips, U1 and U2. The finger switch signals then go straight to the output latch, U3, but the latch will not accept the signal until one of the thumb switches is closed. U4 converts thumb switch signals to the appropriate upper 3 digits of the ASCII code and also commands one half of U5 to start a short time delay. At the end of the delay the latch is enabled during a short pulse from the other half of U5 to accept the finger switch code and the three bits resulting from the thumb switch closure. The finger switches can be closed for any length of time prior to a thumb switch closure. However, after learning to type, they are all closed at approximately the same time. There will be a slight variation in closure times.

The delay of each signal through the debounce chips, U1 and U2 is also variable; it depends upon the contact bounce time of the individual switch. The time delay provided by U5 is longer than these two variables so that the signals are settled when the latch is enabled. Capacitor C1 sets the frequency fo the internal shift register clock of U1 and U2, thus setting the minimum debounce period.

Termination of the delay pulse triggers the enable pulse, and termination of the enable pulse triggers flip-flop U6 to send a Strobe signal to the interface. An Acknowledge pulse from the interface resets U6. Jumpers permit selection of positive or negative polarity for each of these signals and another jumper determines whether the parity line is fixed at a positive or negative level.

The electronic circuit is not critical, but if you build your own unit, pick the switches carefully. PCB surface-mount key switches are the best selection. Pushbuttons generally require too much actuation pressure for comfortable typing, many tend to be electrically noisy and few have snap action. Most keyboard switches are too large for close mounting at the surface of the hemisphere, since they converge radially inside. Long life is essential since one single typewritten page may contain more than 3500 characters.

Several baby toys on the market can be the source for

the five inch plastic hemisphere. Also, some plastic toy balls can be cut in half to get this part. Locate the switches by drawing around your finger tips and arc your thumb over a wide range to locate the thumb switches. If you will be the only user, locate the switches under the pads of your finger tips. The switches can, however, be located even below the top finger knuckles if someone with much smaller hands will also be using the keyboard. It will still be comfortable and easy to use. Drill holes for the switch contact pins and bond the switches on with epoxy cement.

Better yet, order your Writehander™ directly from the manufacturer. For the price of $98 you will receive a completely assembled and tested Writehander™, built with prime quality components, socketed ICs, color coded keys and interface flat cable, a heavy wall injection molded ABS plastic hemisphere, a code chart and complete operating and interface instructions. Specify polarity of your required Strobe and Acknowledge signals and polarity of the fixed parity signal. These options are determined by PCD jumpers and may be changed at any time. The sphere is available in two sizes. Spread your hand on the cover of INTERFACE AGE Magazine. If your thumb pad is centered on the binding edge and your little finger pad is centered on the opposite edge, specify Large Pattern. Otherwise specify Small Pattern.

Now you can build or buy a small, light weight, high speed keyboard that is operated by one hand in a natural relaxed position. It is easier to learn and use than a typewriter keyboard and it eliminates the most common typing error, namely using the correct finger but the wrong hand. The printing or video terminal may be permanently positioned on a separate stand out of your way and attended only to change paper.

Qwerty has done a century of fine service, but now, the Writehander™ does the job better.

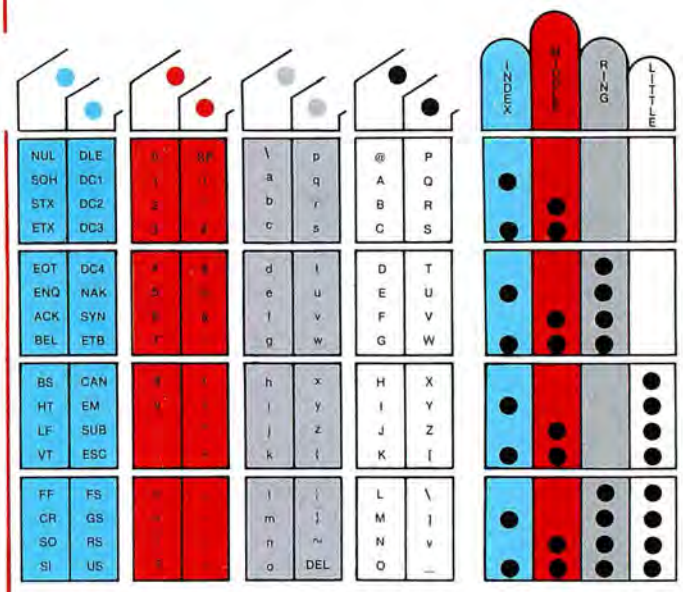

Figure 1. Chart of ASCII code vs. finger and thumb positions. Fingers select character and thumb determines upper or lower case.

NUL	Null
SOH	Start of heading
STX	Start text
ETX	End text
EOT	End of transmission
ENQ	Enquiry
ACK	Acknowledge
BEL	Bell
BS	Backspace
HT	Horizontal tab
LF	Line feed
VT	Vertical tab
FF	Form feed
CR	Carriage return
SO	Shift out
SI	Shift in
DEL	Delete
DLE	Data link escape
DC1	Direct control 1
DC2	Direct control 2
DC3	Direct control 3
DC4	Direct control 4
NAK	Negative acknowledge
SYN	Synchronous idle
ETB	End transmission block
CAN	Cancel
EM	End of medium
SP	Space
SUB	Substitute
ESC	Escape
FS	Form separator
GS	Group separator
RS	Record separator
US	Unit separator

ASCII abbreviations used in Figure 1.

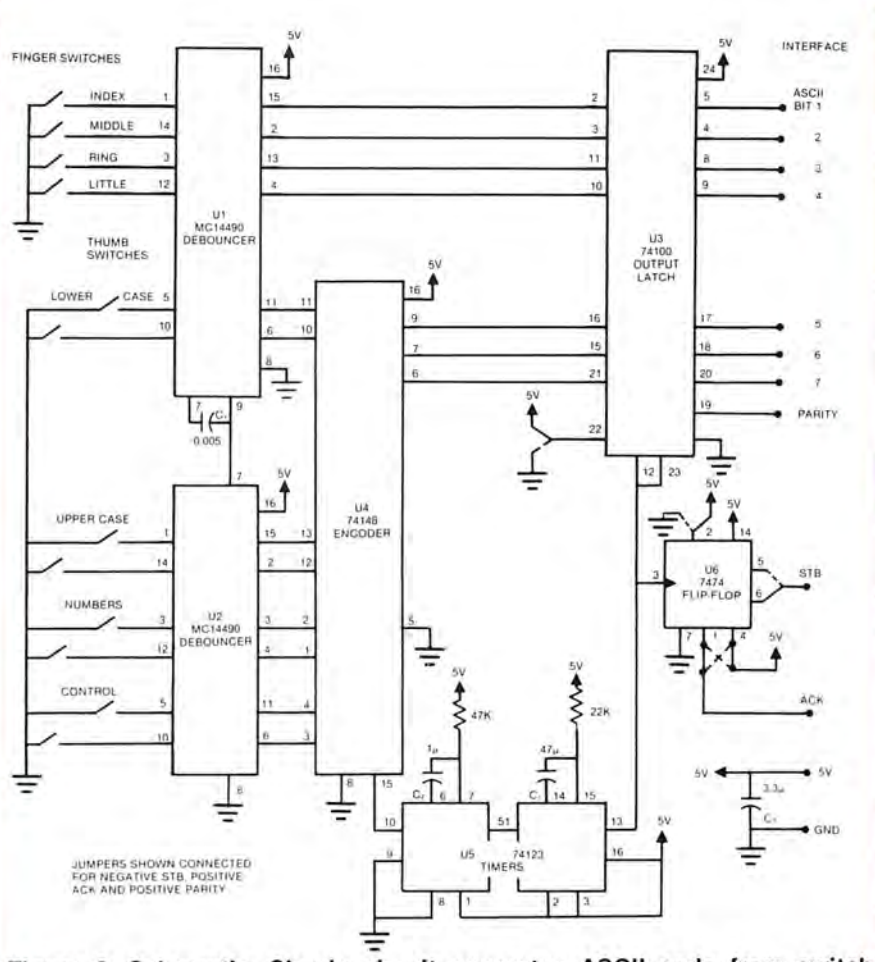

Figure 2. Schematic. Simple circuit generates ASCII code from switch closures.

THE WORD PROCESSOR

When I added a floppy disc to my microcomputer system my first big project was to write a word processor. I got the idea from the "RUNOFF" program on the DEC-20 system I had used. Of course I didn't need, or plan to implement, all the bells and whistles of this fine program. At that, it wasn't as easy as I thought it would be.

It never is.

My first idea was to use random files for easy access to each program line but the fixed length records and the limit to the number of records on a disc soon changed my thinking.

I switched to the sequential file design next, and it worked out admirably.

The original program included the ability to use unjustified lines, right and left justification, and the ability to move, add, delete or change entire lines, lower case, and optional page numbers, titles and subtitles. Also included was single or double spacing.

After using the system for a while I added block moves and deletions, editing within a line, variables, and optional right justification.

Obviously it wasn't as easy to write the program as I had anticipated. Or I should say, it wasn't too hard to write the program, but getting it to run was another story.

But get it running I did, and I've been using it for letters and magazine article manuscripts for some six months. As far as I know, I've got all the bugs out of the program and it will run as advertised just so long as the instructions are followed. These are given in detail and appear elsewhere in the article.

One utility program is required for the use of variables. This feature permits a four line name and address block to be added to each document. It will accept any number of addresses. If you decide to change the utility program to use other size address blocks, or add the salutation of the form letter, or whatever, this program is easily modified. The program is called "DATASAVE". It is used to form a file to hold these address blocks until used. This program is not on the Floppy ROM but appears elsewhere in the article.

Only four format control symbols are used in the program. One error symbol is also used to re-enter a line in the document. If you use these symbols as per the instructions you should have no problems. Once you understand how the program works you will discover a few tricks; but be careful, they can backfire and cause problems.

If you read the program listing you will discover a few of the patches I had to make to the original program to cover conditions I hadn't anticipated. I'm sorry to say it sure isn't top down programming but it doesn't have too many GOSUB's and GOTO's to really confuse the reader.

Each document line is automatically given a line number to reference it for editing. Numbers run from 10 to as high as you wish to go in increments of 10. I have set the edit array for 100 edits which should be ample. If you are short on memory, reducing this will help. This is the only array in the program. Remember, this is for the number of edits, it has no effect on the number of document lines.

Three files are used, all sequential (four if variables are used). One is for the original document, one to hold added, changed or moved lines, and one to hold a few flags and the edit array. This last file is so the edited document can be run again at a later date without having to edit it again. All files use the document file name with an automatically added letter suffix to keep them separate. Incidentally, if variables are used the address block file is retained for the future as well. In fact, if you use the same file name, you can change the document (or form letter) with its edits and use the old address list.

For those not familiar with the MITS BASIC character editor here is a description of those I implemented in this program. (This is the "E" edit option.) The edit commands are not echoed.

The space bar passes over each character in the line, printing it as it goes. This permits you to get to any specific place in the line.

"I" stands for insert. When you space to the point where you want to insert a character or characters type "I" or "i" and then type the inserted material. This inserted material will print on your terminal. To exit insert

Using the Floppy ROM™: How To Load It

The Floppy ROM as originally conceived, is a low cost method of placing viable software into the user's hands. The Word Processor, presented in this issue, is another excellent example of a useful user tool and consequently merited being placed on the Floppy ROM. Therefore in order to insure that all the potential users can make the most of this program, we are again presenting the loading procedure as presented by Bill Turner in the September issue.*

Before proceeding with attempting to load the floppy it is important to read this article. The program is designed to run with MITS 3.4 or 4.0 DISC EXTENDED BASIC. This, as with the other Floppy ROMs, is an absolute requirement. The program is stored on the Floppy ROM in Altair's™ internal format. Also required is a Tarbell™ cassette interface strapped for 187 characters per second operation, an 80 column line printer, and a CRT terminal. A floppy disc drive, or digital cassette system, and at least 20K of memory is required.

Users of other BASIC systems will not be able to use the program without first undertaking some sort of conversion, most of which has been described by Ken in his article. However, here are some important points to remember: Most BASICs do not support the LPRINT command, which directs output to the line printer, and must be changed to a "PRINT" statement. The other major area of incompatibility is that the Altair software does not allow programs to be saved on tape in a normal ASCII format. Altair software compresses the keywords into a unique one or two byte code and then saves the programs.

The best method of loading the program into your 8080 computer system is to play the Floppy ROM on a medium grade stereo system and to re-record the data onto a cassette tape.

The Tarbell interface is sensitive to both tone and volume setting. You will probably have to make delicate adjustments either during recording or playback of the cassette. Once you find the correct setting, there should be no further trouble. Any errors found while loading the program will usually show up as strange line numbers beyond the last valid line in each program. Should this occur, adjust your volume and/or tone setting a little and resume. Follow the editing instructions carefully.

We welcome any suggestions any of you may have regarding loading methods for the Floppy ROM. We request that you fill out the survey form below, add any other comments or suggestions, and send it to us at INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

*Floppy ROM is a reg. trademark of INTERFACE AGE Magazine

SURVEY

QUESTIONS

1. Did your magazine with the Floppy-ROM™ arrive in good condition via the Post Office? ☐ YES ☐ NO
2. What kind of record player did you use? Approximate cost? _____
3. What type of cartridge is on your turntable, ☐ magnetic or ☐ ceramic? If you know, tell us the brand and model. _____
4. Whose 8080 system did you use? Tell us the manufacturer's name, not your friend's. _____
5. What is the memory size of the 8080 system and what peripherals do you have? _____
6. Did you have trouble loading the record? ☐ YES ☐ NO If yes, what? _____
7. How many times did you have to try loading before you were successful? _____
8. Did you have any difficulties that prevented it from operating at all? If so, what were they? _____
9. Did you try loading the computer directly from the record through the interface? ☐ YES ☐ NO
10. What kind of tone control settings did you use and were they critical? _____
11. Was the playback level critical? ☐ YES ☐ NO
12. Did you play it back in ☐ monaural or ☐ stereo?
13. Do you like the Floppy-ROM™ concept? ☐ YES ☐ NO
14. What kinds of programs would you like to see in the future? _____

hit the escape (ESC) key so you can rejoin the line or type CR (carriage return) which will print out the rest of the line and return you to the edit command mode.

"L" or "l" prints out the rest of the line, retaining any edits. You are still in the "E" mode so you can make further changes in the line.

"Q" or "q" aborts the edit, saves the original line, and returns to the edit command mode. You can then edit again, if you wish, by calling the line again.

"H" or "h" deletes the rest of the line, from the point you have spaced to, and enters the "I" mode.

"X" or "x" moves the print head or curser to the end of the original line, then enters the "I" mode.

Backspacing, delete, rubout, back-arrow, or whatever works in the "I" mode only, to delete a just type character. It puts the deleted letter(s) between "/" 's.

"D" or "d" deletes the next character, putting it between "/" 's.

"nD" or "nd" deletes the next n characters.

"C" or "c" changes the next character to whatever you type. The new character prints on your terminal.

"nC" or "nc" changes the next n characters to whatever you type.

The carriage return prints the rest of the line and returns you to the edit command mode.

Any other characters will get you a bell or a beep from your terminal and nothing will happen.

Remember, the "I", "X", "L", n, or any other command letter or number will not echo, nor will an invalid character. Only the space, carriage return, numbers, and valid control characters have any effect.

In function, the program is not too complex. A line number is generated and printed for each document line. You type the line in after each line number. Lines are limited to 120 alphanumerics. If you type in more you get an error indication and the last line number prints again. Be careful in the "E" edit mode. The "I", "H" and "X" commands can insert enough characters to go over the 120 limit, causing problems. The LINE INPUT statement is used so you can use commas, quotes, or anything you wish in the line. The ">" preceding a line means don't justify, print as is in the final printout. Keep such lines to 60 characters or less. A "<" followed by a few random characters or spaces means insert the next variable line here. A "&" at the end of a line means this is the end of a paragraph. A "]" at the end of a line signals the end of the document. Each line is stored in a disc file.

Next you are asked if you wish to edit. The added, moved or replaced lines are stored in a disc file and the line number is entered in the edit array.

When you are finished editing the flags and edit array are stored in a disc file.

You are then presented with a number of format options; page numbers, single or double space, etc.

After that a form feed (control L) is generated to move the paper to the top of the next page.

The edit array is then sorted into numerical order. Each line number is stripped off the program line and compared to the edit array. If a line number between that and the last line number, or that line number, is in the array, appropriate action is taken. If not, the line minus the line number is concatenated to the last line, unless the last line began with a ">" or ended with a "&". Then 60 characters are counted off in the line, and a character count is made back to the last space. The rest of the line (from the space on) is stored, and spaces are added to existing spaces until a count of 60 is reached again. Then the line is printed and we go fetch the next, unless the leftover line is more than 60 characters long.

Of course it is vastly more complicated than this, details are given in the line by line program documentation. The full instructions also appear elsewhere in this article.

If you plan to convert this program from MITS BASIC to some other flavor here are a few suggestions and some explanations of some of the commands.

The LINE INPUT statement doesn't print a prompt (although this wouldn't matter) and accepts any input up to a carriage return. If you don't have this statement you'll probably have to enclose each line of input in double quotes and use the INPUT statement.

I would say a disc system would be necessary, although you probably could use computer controlled tape drives. This would make the searches for editing rather slow though. If you had two tape drives and put the document file on one tape and the edited lines on the other it would probably be usable. If you had all sorts of memory you might put the whole document in an array in memory, edit and replace the lines directly into the array, then dump the edited file onto tape if you wished to reuse it. Obviously this would require a lot of memory, and would make it difficult to add or move lines as well.

To use the string editing (E) feature you need a WAIT and INP statement. The WAIT statement just looks at the input port (in this case the status flags) and resumes the program when the proper input is read (when an input character from the terminal is flagged). The INP statement accepts a character directly from the input port, not through the BASIC's I/O routines. The reason it is done this way is to avoid echoing the control characters. If you don't mind the echo and prompt you could just use the INPUT statement. This might also be done in machine language if you have the USR statement. This allows you to jump to a machine language program and later return to the BASIC program. If you could suppress echo in your BASIC you could do it that way. This would probably require patching your interpreter. Note the control O suppresses printing in some BASIC's but usually automatically goes back to echoing when it gets to an INPUT statement.

All the other statements will probably be in your BASIC. However, your disc file statements may be different. Here's a quick rundown of the file statements used in MITS BASIC so you can convert to your equivalents.

OPEN"O",1,"TEST". Opens sequential file # for recording (output from CPU) for a file to be named TEST.

OPEN"I",2,"TEST". Opens sequential file #2 for playback (input to the CPU) from the file named TEST.

CLOSE 1. Closes file #1 for input and output. Also used with a following OPEN to start reading a file from the beginning again.

PRINT #1,A$. Record A$ in the next position in file #1, which must be OPENed for recording (output).

INPUT #1,A$. Retrieve next string from file #, which must be OPENed for playback (input), and put string in A$.

LINE INPUT #1,A$. Retrieve all characters up to a carriage return from file number 1 and put in A$. As usual, file #1 must be OPENed for playback (input).

IF EOF(1) THEN. . . . If end of file #1 THEN . . .

Another statement you may not have is SWAP. This is simple, SWAP A$,B$ means put the contents of variable A$ in B$, and the contents of variable B$ in A$. Here's another way to do it.

```
10 Z$ = A$:A$ = B$:B$ = Z$
```

assuming Z$ was not being used for something else.

The ":"'s are used to separate BASIC statements in a single line.

I assume you will be able to convert the RIGHT$, LEFT$, and MID$ to your version if different.

I hope this will help you.

If you have any compliments, questions or comments drop me a line. The address is Ken Knecht, *c/o INTERFACE AGE* Magazine, P.O. Box 1234, Cerritos, CA 90701.

INSTRUCTIONS

This program is designed to run with MITS 3.4 or 4.0 DISC EXTENDED BASIC. One disc drive is required. The character editing feature is designed for the MITS SIOA Rev.1 I/O board. To use another board make appropriate changes to lines 6500 and 6510. Note: this only affects the character editing feature.

The program inputs a document in upper or upper and lower case, a line or a part of a line at a time. Note: imbedded spaces in the input are retained, but some spaces may be expanded if the output lines are right justified.

The output of the program is pages of print, 60 characters wide, 58 lines in extent. New pages are preceded by the form feed command (control L) to the printer. If your printer does not use this command you will have to substitute PRINT's to move the paper the required number of lines whenever the control L (CHR$(12)) command is given.

Output options include single or double spacing of lines; variables for names, addresses, salutations, etc. in form letters; printed page numbers; title and subtitle on each page; right justification of lines; and use of upper case input with lower case output.

Several control inputs are used in the line inputs to control output format. Rubout, delete, back-arrow (underline) work at all times to delete an input character. If an input line is incorrect and you wish to re-enter it end the line with a "v", then hit CR (carriage return). Don't use control U or the AT symbol.

To end a paragraph end the last line with a "&". To end the document use the "]" at the end of the last line. To input a line you do not wish to be right justified or changed, precede it with a ">". This line should be 60 characters or less to match the rest of the page. Use only after another line begun with a ">" or "<" or ended with a "&". If you wish the line to be the next line from the variable file precede the line with a "<" followed by several other characters. I generally use three or four spaces. This line will not be used so any alphanumerics can be used after the "<" except "v" or "]". To enter a blank line use the ">" and several (3 or 4) spaces. This should only follow a line ended with a "&" or begun with a "<" or ">". The end of paragraph indicator "&" will also be followed by a blank line, or three blank lines if double spacing. These are the only symbols you need remember. Don't use the "<", ">", "&" or "]" on a line by itself.

To run the program load the program file in memory and run it. You will be asked for a file name. Use any legal file name, but use only seven characters or less. This is important. You will then be asked if it is an old file. If you are re-running an old document type "Y" (upper case). Any other response will erase any file of that name. Then, if a new file, you will get "TYPE LINE, THEN CARRIAGE RETURN". On the next line will be printed a line number, starting with 10 in increments of 10. To each line number type a line or part of a line. Each time you hit CR you will get the next line number. Lines should be at least four or five characters long. If the line is over 120 characters long it will be rejected and the last line number will print again. You can break sentences, they will be rejoined in the final copy. The program will automatically put a space between each entered line. Remember, all imbedded spaces will be retained in the final copy. Use the symbols mentioned earlier to determine the format of the document. When you end the last sentence with the "]" the input phase of the program will end.


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UP AND RUNNING

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Next, whether an old file or a new file, the program will print "DO YOU WANT TO SEE THE FILE?". If answered with "Y" (upper case), the program will print out the file, with line numbers. Note that an "/" will be added at the begining of each line. This will be deleted when the document is printed, as will the line numbers. The line numbers are only used for reference when editing. Next you will be asked "DO YOU WANT TO SEE OLD EDITS?". This is only applicable for an old file. Answer "Y" (upper case) to review if desired and if they are present. Note: old edits can be present if the file name was used before.

Next you will be asked if you wish to edit. If you do, answer "Y" (upper case). You will next be asked "HOW?". After the initial edit command, edit commands are prompted by the "?".

You can use the following edit features:

"R": This replaces an input line with a new one. Use the line number as the reference. Note: If the old line ended with a "&" or "]" retain this in the new one or the results will be uncertain. Do not add a "&" or "]".

"A": This adds a new line to the document. Use a line number between the lines where you wish it to appear. Do not end an added line with a "&". Note: you can add up to nine lines between two original lines.

"S": This adds a blank line. Use only after a line beginning with "<" or ">" or ending with "&". Use a line number between existing line numbers, as with "A".

"D": This deletes a line.

"M": This moves a line. Program will ask for original line number and new line number. Moved line will be printed on terminal. The search for this may take a while in a long file.

"BM:" This moves up to nine lines at a time. Program will ask for first and last line numbers (inclusive) of lines to be moved. Then first line number of area to be moved to. Make sure you do not write over any original lines or move will be aborted at this line (even if it has been deleted). You can write over any previously moved or added lines. Moved lines will be printed on terminal. Some search delay is to be expected.

"BD": This will delete any number of consecutive original lines, even if replaced or deleted. Will not affect any moved or added lines, or blank lines added with edit. Program will ask for first and last line number (inclusive).

"E": This allows use of character editing ala MITS BASIC. Supports (N)D, (N)C, I, L, Q, X, and H. Edit commands are not echoed and can be in upper or lower case. Works same as MITS character editor. However, the "." will not return the last line edited, you have to use the line number. As in the line move, the file has to be searched for the line to be edited and may take a few seconds or longer. Note previous remarks about I/O board.

"F": This exits the edit mode of the program.

Lines can be edited in any order. Only the last edit to any given line will be used.

You will next be asked "VARIABLES?". If you are using variables, more later, answer "Y" (upper case).

Then "DOUBLE SPACE?". If "Y" (upper case), the final printout will be double spaced.

Then "LOWER CASE?". If "Y" (upper case) then converts any upper case letters in document to lower case unless preceded by a "/". Can be used to input a document on an upper case only CRT and output on an upper and lower case printer.

Then "JUSTIFY RIGHT?". If "N" (upper case) then prints out ragged right but keeps lines to 60 characters or less.

Then "PRINT PAGE NUMBERS?". If "Y" (upper case) then prints consecutive page numbers centered at the top of each of page of printout. This line and the follow-

ing blank lines are included in the 58-line page length.

Then "TITLE". If you want a title type "Y" (upper case). You will then be asked to input desired title. It will be started at the left edge of the page unless you precede it with spaces to center it. If you use the title you will then be asked "SUBTITLE?". This too will be printed at the left edge of the page unless spaces are used. If no subtitle hit CR. Title, subtitle and following blank line are included in the 58-line page length.

The formfeed will then move the paper to the top of the next page and print out the document. Justified lines take from 5 to 10 seconds of computer time per line. Other lines print almost immediately.

At the conclusion another formfeed appears, then you are asked if you wish another copy. If "Y" (upper case) then the "VARIABLES?", etc. are asked again and another copy is printed. Else BASIC exits program and types OK.

As to the variables, the variable file program is "DATASAVE". (See Figure 1) You must use this program to put names and addresses or whatever in a file before you run the "AUTHOR" program. It is set up for a four line address to be inserted in the document file used in "AUTHOR". You can change the "DATASAVE" program to store whatever variables you wish. As set up, each variable line is stored with an initial ">" to keep it on a line by itself when printed. When variables are used the "AUTHOR" program will continuously print copies of the document using the variables as they appear in the file until the file is empty. The "VARIABLES?", etc. routine will only appear once for the original document. Thus is 20 sets of names and addresses are stored in "DATASAVE" "AUTHOR" will print out 20 documents with no operator input required.

Note that if the edit line is changed when re-running a document all the old edits are lost.

```
LOAD"DATASAVE
OK
LIST

10 CLEAR 1000
20 PRINT"PROGRAM COPYRIGHT 1977 BY KENNETH B. KNECHT":PRINT:PRINT
30 PRINT"THIS PROGRAM STORES VARIABLES TO BE USED"
40 PRINT"AS NAMES AND ADDRESSES IN THE WORD PROCESSING"
50 PRINT"PROGRAM. SIMPLY USE FILE NAME OF DOCUMENT"
60 PRINT"AND TYPE IN A FOUR LINE ADDRESS AS REQUESTED."
70 PRINT"FILE NAME":INPUT A$
80 OPEN"O",1,A$+"D"
90 PRINT"NAME OR DEPARTMENT":LINE INPUT B$:PRINT#1,B$
100 PRINT"COMPANY":LINE INPUT B$:PRINT#1,B$
110 PRINT"ADDRESS":LINE INPUT B$:PRINT#1,B$
120 PRINT"CITY, STATE AND ZIP":LINE INPUT B$:PRINT#1,B$
130 PRINT"MORE":INPUT B$
140 IF LEFT$(B$,1)="Y" THEN 90
150 CLOSE 1:END
OK
```

Figure 1

DOCUMENTATION

Following is a line by line breakdown of the program.

LINE	COMMENT
1	Initialize variables. Note CH(100,1) sets maximum number of edits to 100. Change if desired.
2	Finds old file or starts new one.
3	Puts 0's in CH array.
4	Permits re-running old file.
5	Erases old file of the same name if present and opens new document file.
40-52	Begins accepting document lines. Does not

print question mark but prints line numbers of input lines. Increments line number.

55 Allows line to be re-entered if a mistake is made.

60 If line is over 120 characters long causes it to be re-entered. There is a 128 character limit in line input statement. Other eight characters are saved for line number, space and flag (see 85).

70 If no line input then re-enters line.

80 Line too long warning.

85 Puts line number, space, "/" and line in A$. The "/" is so program can drop off line number when printing document.

90 Put A$ in disc file.

130 Checks for "]" at end of line. This signals last line of document. If found jumps to end of input routine else goes back to line 50.

200 Closes file for input.

202 Asks if file is to be printed.

210-240 Prints file until last line is reached (22), then closes file.

242 Permits edit file to be read. Only applicable to old edited file.

243-246 Prints edits. Same as print file routine.

252-265 Permits file to be edited. You cannot change edit file but must re-edit completely. Once you type "Y" you are committed to re-editing the whole file as you have erased the old edits. Note if you do not edit, the old edit file for that file name will be re-used if it exists.

270-296 Select method of editing.

300-310 Instructions for editing.

315-320 Replacing line routine. See 3000. Z = edit number. CH(Z,0) puts line edited into array. 316 accepts replacement line. 318 see 55. 320 stores new line in edit file. See 3100.

325-332 Moves line. See 3000. CH(Z,1) puts flag for moved line in array (so original line number will be skipped). See 3120. Also forces fetch of line if not requested as line is needed to be put into edit file (330).

335-350 Add a line routine. Gets new line number and line, permits re-entering, then see 3100.

360 Adds a blank line. Should be used only after a paragraph flag (see program instructions). CH(Z,1) flags a blank line.

370 Delete a line. See 3000. CH(Z,1) flags deleted line.

415-430 Used to finish editing routine.

490 Saves number of edits, number of lines, edit flag and CH array for future edits in a file.

500-510 Sets variables for printout routine.

515-608 Flags for spacing, variables, lower case, page #'s and title. Also stores title and subtitle if used.

610 Advances paper to top of next page to begin printout.

611 Print page number (if used). Increment page line count.

612 Prints title and subtitle (if used). Increments line count.

613 Recovers information stored in 490. Useless for first run but required if printing is done at another time.

645 If line at end of paragraph or document is saved in B$ (see 850) then it is transferred to A$ (see 665) and processed. We don't want to add the next line, if any, to this line. We then skip getting new line and its processing.

646 If line saved in B$ (see 850) is over 60 characters long we do not need a new line so we skip that portion of the program.

647 If there were no added or moved lines before the next regular line number then we increment line number to that of next line expected else we check for additional lines in 655. Z8 is added line flag. See 655.

648 No edits (ED = 0) so if last line in file we're done.

650 If no edits and not last line we get next line from document file and skip lines checking for edits.

655-660 We check for an added line before next expected line. If we find it we fetch it and use it for our next line in 685. We also set flag (Z8 = 1) in case there are further added or moved lines before the next regular line number. See 647. If no further added lines we set Z8 to 0 and get next line in 655 or skip to end if last line in file.

665 Get next line from document file.

670-675 Check for blank, deleted or replaced line. If none is found we go on to process line gotten in 665.

680 If moved or deleted we skip line and go back to 645.

685 If blank line we print CR and go back to 645.

695-698 If not blank or deleted we assume line was replaced or added or moved from another line. We open file of edited lines and strip off each line number (see 4100) and check against current line number. We go thru the

whole file to be sure we get the last edit to that line. Then we replace the line from 665 with the last new line of that number.

700-725 Close edit file. We count characters in line until we get to the "/" inclusive.

730 We delete line number and "/" from line.

760 If lower case not flagged we go to 790.

765-785 If lower case flagged we scan line for "\" (flag for next character to be upper case). When we find it we delete it and set L2 flag to 1. This means we do not add 32 to ASCII value of next character, (leaving it upper case). All other alphabetic characters are converted to lower case (by adding 32 to ASCII value).

790 If first character of line is ">" we delete the ">" and continue else we jump to 815.

795 Flag A$ as to be unjustified with P7 = 1. This is in case B$>61.

800 We flag unjustified line (F6 = 1) if nothing in B$ (see 850). Then we go to 835.

803 If there is a line in B$ we check to see if it the end of a paragraph (&). If not and it is less than 61 characters we print it.

805 If B$ is the end of a paragraph and contains less than 62 characters we delete the "&" and print it.

807 Assumes the length of B$ is over 60 characters so justified it in 1030 but flags it so the remainder of B$ will go back to 803 after justifying.

810 Skips line 815.

815 Used if A$ is not an unjustified line.

820 Adds A$ to B$ making whole thing A$.

830 If A$>60 then goes to justify routine.

835 Checks A$ (less than 60) for end of paragraph. If so deletes "&" and prints it. PA = 1 is flag to follow with blank line(s).

840 Check A$ (less than 60) for end of document. If so deletes "]" and prints it. E = 1 is flag to go to end.

845 If line is not to be justified skips justification routine and prints it.

850 Assumes A$ is less than 60 and not a paragraph ending or end of piece. Stores A$ in B$ and goes to pick up the next line at 645. Thus B$ is a line or end of a line that is not long enough to be justified. See also 1090 for B$ creation.

1030-1040 Counts spaces in A$ up to 60th character and stores count in S. Goes to 1290 in case 61st character is a "]" or "&" in which case line is used as is. In this case return is left unused on stack.

1050-1080 Counts backwards from the 60th character in A$ to the first space. Then X is count of characters to be deleted from line and replaced with spaces.

1090 Puts justifiable portion of A$ in A$, remainder of line in B$.

1095 If document is not to be right justified goes to print line.

1100-1270 Determines how to divide extra spaces evenly in line and then does so to bring character count back to 60.

1280 Prints line (finally!). If there are still characters in B$ and A$ (line presently stored in A9$) is not to be justified goes back to 803.

1285 Go to 645 and do it all again.

1290-1330 See 1030-1040.

1370-1490 Prints extra line if double space, prints blank lines after paragraphs, prints page number and title if new page is started, and counts number of lines to check for the end of the page. Goes to end if document is finished. Advances to next page.

1520-1530 End of program routine. If variables are used (DT = 1) and there are still names in the variable file then run another copy.

3000 Requests line number for replaced or moved line edit. Asks if line is to be printed. This is optional as search routine to fetch line takes a while in a long file and you may not wish to wait.

3010-3030 Fetches line to be edited and prints it. Fetches each line, strips off line number in 4100 and compares it to line requested. Prints line when successful.
Note: I tried faster scheme of calculating the number of lines to skip by the line number and then using a for loop to go directly to that line. However, for some reason that does not always work. Hence the slower routine.

3040 Return

3100-3110 Prints new line in edit file with line number. Increments edit number.

3120-3130 Prints moved line (K1$) in edit file removing old line number and replacing with new one.

3950-3985 Put edit line numbers in order in CH array. Deletes duplicate numbers, retaining last entered. Uses bubble sort.

4000-4035 Counts characters used for line number so it can be deleted.

4100-4140 Extracts, but does not delete line number for comparison purposes.

5000-5050 Subroutine for 1370-1490 routine.

5060-5080 Gets information for block move.

5090-5120	Moves lines (see 325-330). Checks to see if a moved line number is a multiple of 10. If so aborts move at previously moved line.
5130-5140	Gets information for block deletion.
5150-5170	Deletes lines.
6000	Inputs line number to be edited and prints it.
6010	Character input routine
6020-6120	Select mode
6130	Line ended, no more printing possible.
6140	LE is character count. D$ is edited string.
6150-6160	Add another digit to (n) or save first digit.
6170	Only one character to change.
6171-6173	Multiple character change. Change characters one by one, keep character count up to date.
6174	Change only one character.
6180	Only one character to delete.
6190-6210	Print deleted characters. Keep character count up to date.
6220	Print one deleted character. Reduce character count.
6230-6250	Print rest of C$ line, put it in D$ and reset character count to 1 to re-edit line.
6260	Q command. Abort string changes and return to program.
6270	I command. Get first inserted character.
6272	Check for rubout.
6274	Check for escape to end insert.
6275	Check for carriage return (CR) to end insert.
6280	Insert new character, look for more.
6290-6310	X command. Go to end of line and enter insert mode. Print characters and put in D$.
6320	Make H command point end of C$. Go to insert.
6330	If input is CR and we are at the end of C$ then add CR to D$. Put D$ on disc. Return to program.
6340-6360	If CR and not at end of C$ print remaining characters. Put in D$. Put D$ in edit file. Return to program.
6370	Rubout routine. Print initial "\".
6380	Print last entered character. Delete last entered character from D$.
6390	Get next character. If another rubout GOTO 6380.

6400 Rubout ended. Print final "/" and send character to 6020 to be evaluated.

6500 Wait for an input character from TTY input port.

6510 Character inputted and masked for seven bits. Change input to a one character string and evaluate in 6020.

SAMPLE RUN

```
      run
COPYRIGHT 1977 BY KENNETH B. KNECHT
FILE NAME,(7 LETTERS MAXIMUM)? IAART
IS THIS AN OLD FILE?
? N
TYPE LINE, THEN CARRIAGE RETURN.
 10  When I added a floppy disk to my microcomputer system
 20  my second big project was to write a word processor.
 30  I got the idea from the "RUNOFF" program on the DEC-20 system I had
used.
 40  It wasn't as easy as I thought it would be.&
 50  It usually isn't.&
 60  my first idea was to use random records for easy access to each pro
gram line but the fixed length records and the limit to the number of re
cords on a disc\c\k soon changed my thinking.&
LINE TOO LONG. PLEASE RE-ENTER.
 60  My first idea was to use random records for easy access to each pro
gram line
 70  but the fixed lent\t\gth records and the limit to the number of rec
ords on a disk
 80  soon changed my thinking.&
 90  So I thought I would^
RE-ENTERING LINE.
 90  So I sat down and thought some more.
 100  I switched to the sequential file next,
 110  and it worked out admirably.]
DO YOU WISH TO SEE THE FILE?
? Y
 10 /When I added a floppy disk to my microcomputer system
 20 /my second big project was to write a word processor.
 30 /I got the idea from the "RUNOFF" program on the DEC-20 system I had
used.
 40 /It wasn't as easy as I thought it would be.&
 50 /It usually isn't.&
 60 /My first idea was to use random records for easy access to each pro
gram line
 70 /but the fixed length records and the limit to the number of records
 on a disk
 80 /soon changed my thinking.&
 90 /So I sat down and thought some more.
 100 /I switched to the sequential file next,
 110 /and it worked out admirably.]
DO YOU WISH TO SEE OLD EDITS?
? y\y\Y
FILE NOT FOUND IN 243
Ok
RUN
COPYRIGHT 1977 BY KENNETH B. KNECHT
FILE NAME,(7 LETTERS MAXIMUM)? IAART
IS THIS AN OLD FILE?
? Y
DO YOU WISH TO SEE THE FILE?
? N
DO YOU WISH TO SEE OLD EDITS?
? N
DO YOU WISH TO EDIT?
? Y
ENTER NUMBER OF LINES
? 11
NOW?
? E
WHAT IS THE LINE NUMBER?
? 10
 10 /When I added a floppy disk to my microcomputer system
 10 /When I a\d\dded a floppy disk to my microcomputer system
? E
WHAT IS THE LINE NUMBER?
? 20
 20 /my second big project was to write a word processor.
 20 /my \second\FIRST big project was to write a word processor.
? E
WHAT IS THE LINE NUMBER?
? 20
 20 /my second big project was to write a word processor.
 20 /my \second\first big project was to write a word processor.
? A
NEW LINE NUMBER?
? 35
NEW LINE?
Of course I didn't need, or plan to implement, all the bells and whistle
s of this fine program.
? E
WHAT IS THE LINE NUMBER?
? 40
 40 /It wasn't as easy as I thought it would be.&
 40 /At that, it wasn't as easy as I thought it would be.&
? E
WHAT IS THE LINE NUMBER?
? 50
DO YOU WANT TO SEE THE LINE?
? N
REPLACEMENT LINE?
It never is.&
? E
WHAT IS THE LINE NUMBER?
? 60
 60 /My first idea was to use random records for easy access to each pro
gram line
 60 /My first idea was to use random \records\files for easy access to e
ach program line
? D
WHAT IS THE LINE NUMBER?
? 90
DO YOU WANT TO SEE THE LINE?
? Y
 90 /So I sat down and thought some more.
DELETED LINE 90
? E
```


"Good Lord! The vote's a tie - *we'll* have to cast the deciding vote.

```
WHAT IS THE LINE NUMBER?
? 100
 100 /I switched to the sequential file next,
 100 /I switched to the sequential file design next,
? F

CHECK COPY AGAIN BEFORE ANSWERING 'YES' TO NEXT QUESTION.
FINISHED
? Y
VARIABLES
? N
DOUBLE SPACE
? Y
LOWER CASE
? N
JUSTIFY RIGHT
? Y
PRINT PAGE NUMBERS
? N
TITLE ON EACH PAGE
? Y
TITLE?
? The Word Processor
SUBTITLE?
? knecht
```

(See Figure 2.)

The Word Processor
knecht

When I added a floppy disk to my microcomputer system my first big project was to write a word processor. I got the idea from the "RUNOFF" program on the DEC-20 system I had used. Of course I didn't need, or plan to implement, all the bells and whistles of this fine program. At that, it wasn't as easy as I thought it would be.

It never is.

My first idea was to use random files for easy access to each program line but the fixed length records and the limit to the number of records on a disk soon changed my thinking.

I switched to the sequential file design next, and it worked out admirably.

Figure 2.

"I programmed my computer to do my work for me and BAM! The rest is history."

SOURCE LISTING OF PROGRAM

```
LIST 'AUTHOR

1 CLEAR 1000:E=0:DIM CH(100,1):J=0:ED=0:D$="":B=0:Z=0:F5=0:PRINT"COPYRIG
HT 1977 BY KENNETH B. KNECHT
2 INPUT"FILE NAME,(7 LETTERS MAXIMUM)";A2$:IF LEN(A2$)>7 THEN 2
3 FOR X%=1 TO 100:FOR Y%=0 TO 1:CH(X%,Y%)=0:NEXT Y%,X%
4 PRINT"IS THIS AN OLD FILE?":INPUT A1$:IF LEFT$(A1$,1)="Y" THEN F5=1:
  GOTO 202
5 OPEN"O",1,A2$
40 PRINT"TYPE LINE, THEN CARRIAGE RETURN."
50 B=B+10
52 PRINT B;" ";:LINE INPUT A$
55 IF RIGHT$(A$,1)="^" THEN PRINT"RE-ENTERING LINE.":GOTO 52
60 IF LEN(A$)>120 THEN 80
70 IF LEN(A$)=0 THEN 52 ELSE 85
80 PRINT"LINE TOO LONG. PLEASE RE-ENTER.":GOTO 52
85 A$=STR$(B)+" /"+A$
90 PRINT #1,A$
130 IF RIGHT$(A$,1)="]"THEN 200 ELSE 50
200 CLOSE 1
202 PRINT"DO YOU WISH TO SEE THE FILE?":INPUT A1$:IF LEFT$(A1$,1)<>"Y"
    THEN 242
210 OPEN"I",1,A2$
220 IF EOF(1) THEN 242
230 LINE INPUT #1,A$:PRINTA$:GOTO 220
240 CLOSE 1
242 PRINT"DO YOU WISH TO SEE OLD EDITS?":INPUT A1$:IF LEFT$(A1$,1)<>"Y"
THEN 252
243 OPEN "I",2,A2$+"E"
244 IF EOF(2) THEN 246
245 LINE INPUT #2,A$:PRINT A$:GOTO 244
246 CLOSE 2
252 PRINT"DO YOU WISH TO EDIT?"
255 INPUT A1$
260 IF LEFT$(A1$,1)<>"Y" AND F5=1 THEN 500
261 IF LEFT$(A1$,1)<>"Y" AND F5<>1 THEN 490
262 IF F5=1 THEN PRINT"ENTER NUMBER OF LINES":INPUT B1:B=B1*10
263 PRINT"HOW?"
265 OPEN"O",2,A2$+"E":ED=1
270 INPUT A1$
272 IF LEFT$(A1$,2)="BM" THEN 5060
273 IF LEFT$(A1$,2)="BD" THEN 5130
275 IF LEFT$(A1$,1)="M"THEN 325
280 IF LEFT$(A1$,1)="R"THEN 315
285 IF LEFT$(A1$,1)="S" THEN 360
287 IF LEFT$(A1$,1)="D"THEN 370
290 IF LEFT$(A1$,1)="A"THEN 335
295 IF LEFT$(A1$,1)="F"THEN 415
296 IF LEFT$(A1$,1)="E" THEN 6000
300 PRINT"USE A (ADD A LINE), D (DELETE A LINE), E (EDIT WITHIN A LINE),
"
305 PRINT"M (MOVE A LINE), R (REPLACE A LINE), S (NULL LINE),"
307 PRINT"BM (BLOCK MOVE), BD (BLOCK DELETION),"
310 PRINT"OR F (FINISHED).":PRINT:GOTO 270
315 GOSUB 3000:PRINT"REPLACEMENT LINE?":Z=Z+1:CH(Z,0)=C
316 LINE INPUT D$
318 IF RIGHT$(D$,1)="^" THEN PRINT"RE-ENTERING LINE":GOTO 316
320 D=C:GOSUB 3100:GOTO 270
325 GOSUB 3000:PRINT"NEW LINE NUMBER?":INPUT D:Z=Z+1:CH(Z,0)=C:CH(Z,1)=1
:Z=Z+1:CH(Z,0)=D
330 IF LEFT$(A1$,1)<>"Y" THEN PRINT"MOVED LINE":GOSUB 3010
332 GOSUB 3120:GOTO 270
335 PRINT"NEW LINE NUMBER?":INPUT D:Z=Z+1:CH(Z,0)=D
340 PRINT"NEW LINE?":LINE INPUT D$:IF RIGHT$(D$,1)="^"
    THEN PRINT"RE-ENTERING LINE":GOTO 340
350 GOSUB 3100:GOTO 270
```

```
360 PRINT"LINE NUMBER?":INPUT C:Z=Z+1:CH(Z,0)=C:CH(Z,1)=3:GOTO 270
370 GOSUB 3000:Z=Z+1:CH(Z,0)=C:CH(Z,1)=2:PRINT"DELETED LINE";C:GOTO 270
415 PRINT"CHECK COPY AGAIN BEFORE ANSWERING 'YES' TO NEXT QUESTION."
420 PRINT"FINISHED":INPUT A1$
430 IF LEFT$(A1$,1)="Y"THEN 490 ELSE 270
490 CLOSE 2:OPEN"O",2,A2$+"N":PRINT #2,D,Z,ED:FOR X%=1 TO Z:FOR Y%=0 TO
1:
PRINT #2,CH(X%,Y%):NEXT Y%,X%:CLOSE 2
500 L1=0:L=0:D=0:C=0:P1=0:T=0:B$="":P=0:E=0:L2=0
510 P2=1:C$="":B1=0:Z8=0:F6=0:F7=0:P7=0:NJ=1
515 PRINT"VARIABLES":INPUT A1$
516 IF LEFT$(A1$,1)="Y" THEN OPEN"I",4,A2$+"D":DT=1
520 PRINT"DOUBLE SPACE":INPUT A1$
530 IF LEFT$(A1$,1)="Y"THEN D=1 ELSE D=0
540 CLOSE 1:OPEN"I",1,A2$
550 PRINT"LOWER CASE":INPUT A1$
560 IF LEFT$(A1$,1)="Y"THEN L=1 ELSE L=0
562 PRINT"JUSTIFY RIGHT":INPUT A1$
564 IF LEFT$(A1$,1)="N" THEN NJ=0
570 PRINT"PRINT PAGE NUMBERS":INPUT A1$
580 IF LEFT$(A1$,1)="Y"THEN P1=1 ELSE P1=0
590 PRINT"TITLE ON EACH PAGE":INPUT A1$
600 IF LEFT$(A1$,1)="Y"THEN T=1 ELSE GOTO 610
605 PRINT"TITLE?":INPUT T$
608 PRINT"SUBTITLE?":INPUT T1$
610 PRINT CHR$(12)
611 B1=0:IF P1=1 THEN PRINT TAB(39);"(";P2;")":P2=P2+1:PRINT:L1=L1+2
612 IF T=1 THEN PRINT TAB(8);T$:PRINT TAB(8);T1$:L1=L1+3:PRINT
613 OPEN"I",2,A2$+"N":INPUT #2,B,Z,ED:FOR X%=1 TO Z:FOR Y%=0 TO 1:
INPUT #2,CH(X%,Y%):NEXT Y%,X%:CLOSE 2:GOSUB 3950
645 IF B$<>"" AND( RIGHT$(B$,1)="&" OR RIGHT$(B$,1)="]") THEN A$=B$:B$="
":J9=LEN(A$):GOTO 830
646 IF LEN(B$)>60 THEN A$=B$:B$="":J9=LEN(A$):GOTO 830
647 IF Z8=0 THEN B1=B1+10
648 IF ED=0 THEN IF EOF(1) THEN 1520
650 IF ED=0 THEN LINE INPUT #1,A$:GOTO 700
655 J9=0:FOR X%=1 TO Z:IF CH(X%,0)<B1 AND CH(X%,0)<>0 THEN B2=CH(X%,0):
    CH(X%,0)=0:Z8=1:GOTO 685
660 NEXT:Z8=0:IF EOF(1) THEN 1520
665 LINE INPUT #1,A$
670 FOR X%=1 TO Z:IF CH(X%,0)=B1 THEN CH(X%,0)=0:B2=B1:GOTO 680
675 NEXT:GOTO 700
680 IF CH(X%,1)=1 OR CH(X%,1)=2 THEN CH(X%,0)=0:A$="":GOTO 645
685 IF CH(X%,1)=3 THEN PRINT CHR$(13):CH(X%,0)=0:GOSUB 1370:GOTO 645
695 OPEN"I",2,A2$+"E"
696 IF EOF(2)THEN 700
697 LINE INPUT #2,C$:GOSUB 4100:IF VAL(N3$)=B2 THEN A$=C$:C$=""
698 GOTO 696
700 C$="":CLOSE 2:L5=0:FOR X%=1 TO 8:F$=MID$(A$,X%,1)
705 IF F$="/"THEN L5=L5+1:GOTO 730
715 L5=L5+1
725 NEXT
730 A$=RIGHT$(A$,LEN(A$)-L5):J9=LEN(A$)
740 IF LEFT$(A$,1)="<" THEN LINE INPUT #4,A$ ELSE GOTO 760
750 A$=">"+A$:J9=LEN(A$)
760 IF L=0 THEN 790
765 L2=0:FOR X%=1 TO J9:F$=MID$(A$,X%,1)
770 IF L2=0 THEN IF F$=>"A" AND F$<="Z"THEN Z1=ASC(F$)+32:F$=CHR$(Z1):GO
TO 780
775 IF F$="\"THEN L2=1:GOTO 785
780 C$=C$+F$:L2=0
785 NEXT:A$=C$:C$="":J9=LEN(A$)
790 IF LEFT$(A$,1)=">"THEN A$=RIGHT$(A$,J9-1)ELSE 815
795 IF B$<>""THEN P7=1
800 IF B$=""THEN F6=1:J9=LEN(A$):GOTO 825
803 IF RIGHT$(B$,1)<>"&" AND LEN(B$)<61 THEN PRINT TAB(8);B$:B$="":GOSUB
 1370:P7=0
805 IF RIGHT$(B$,1)="&" AND LEN(B$)>61 THEN B$=LEFT$(B$,LEN(B$)-1):P7=0:
```

```
PRINT TAB(8);B$:
    PA=1:GOSUB 1370:D$=""
807 IF P7=1 THEN A9$=A$:A$=B$:GOTO 1030
810 GOTO 820
815 IF B$<>""THEN 805
820 IF B$<>""THEN A$=B$+" "+A$:J9=LEN(A$):B$=""
830 IF J9>60 THEN 1030
835 IF RIGHT$(A$,1)="&"THEN PA=1:A$=LEFT$(A$,J9-1):F6=0:J9=LEN(A$):GOTO
1280
840 IF RIGHT$(A$,1)="]"THEN E=1:A$=LEFT$(A$,J9-1):F6=0:J9=LEN(A$):GOTO 1
280
845 IF F6=1 THEN F6=0:GOTO 1280
850 B$=A$:GOTO 645
1030 S=0:FOR X%=1 TO 60:F$=MID$(A$,X%,1):IF F$=" "THEN S=S+1
1040 C$=C$+F$:NEXT:GOSUB 1290
1050 D$="":X=0:S=S-1
1060 FOR X%=60 TO 30 STEP -1
1070 F$=MID$(C$,X%,1):X=X+1
1080 IF F$=" " THEN 1090 ELSE NEXT
1090 B$=RIGHT$(A$,LEN(A$)-61+X):A$=LEFT$(C$,LEN(C$)-X)
1095 IF NJ=0 THEN C$=A$:GOTO 1270
1100 J9=LEN(A$):Q=60-J9:S2=0:C$="":TI=0
1135 IF Q<=S THEN S1=1:GOTO 1180
1150 IF Q>S*3 THEN S1=4:GOTO 1180
1160 IF Q>S*2 THEN S1=3:GOTO 1180
1170 IF Q>S THEN S1=2
1180 FOR X%=1 TO J9:F$=MID$(A$,X%,1)
1190 IF F$<>" "THEN 1260
1210 IF S1=1 AND Q-S2=0 THEN F$=" ":GOTO 1250
1215 IF S1=1 THEN F$="  ":S2=S2+1:GOTO 1250
1220 IF S1=2 AND Q-S2=S-TI THEN F$="  ":S2=S2+1:GOTO 1250
1225 IF S1=2 THEN F$="   ":S2=S2+2:GOTO 1250
1230 IF S1=3 AND Q-S2=(S-TI)*2 THEN F$="   ":S2=S2+2:GOTO 1250
1235 IF S1=3 THEN F$="    ":S2=S2+3:GOTO 1250
1240 IF S1=4 AND Q-S2=(S-TI)*3 THEN F$="    ":S2=S2+3:GOTO 1250
1245 IF S1=4 THEN F$="     ":S2=S2+4
1250 TI=TI+1
1260 C$=C$+F$:NEXT
1270 A$=C$:C$=""
1280 PRINT TAB(8);A$:D$="":C$="":GOSUB 1370:IF P7=1 THEN P7=0:A$=A9$:
    A9$="":GOTO 803
1285 GOTO 645
1290 F$=MID$(A$,61,1)
1295 IF F$="&"THEN PA=1:A$=LEFT$(A$,J9-1):GOTO1280
1320 IF F$="]"THEN E=1:A$=LEFT$(A$,J9-1):GOTO 1280
1330 RETURN
1370 IF PA=1 AND D=1 THEN 1440
1380 IF PA=1 AND D=0 THEN 1450
1390 IF D=1 THEN 1455
1400 IF E=1 THEN 1520
1405 L1=L1+1
1410 IF P1=1 THEN IF L1>58 THEN 1460
1420 IF T=1 THEN IF L1>58 THEN 1470 ELSE 1490
1430 IF L1>58 THEN PRINT CHR$(12):L1=0:GOTO 1490
1435 RETURN
1440 PRINT:PRINT:PRINT:L1=L1+3:PA=0:H$="":GOTO1400
1450 PRINT:L1=L1+1:PA=0:H$="":GOTO1400
1455 PRINT:L1=L1+1:GOTO1400
1460 PRINT CHR$(12):L1=0:GOSUB 5000:GOTO 1490
1470 PRINT CHR$(12):L1=0:GOSUB 5010:GOTO 1490
1480 IF L1>58 THEN PRINTCHR$(12):L1=0
1490 RETURN
1520 E=0:PRINTCHR$(12)
1525 IF DT=1 THEN IF EOF(4) THEN 1530
1527 IF DT=1 THEN CLOSE 1:L1=0:OPEN"I",1,A2$:GOTO 611
1530 INPUT"ANOTHER COPY";A1$:IF LEFT$(A1$,1)="Y"THEN 500 ELSE END
3000 ED=1:PRINT"WHAT IS THE LINE NUMBER?":INPUT C:PRINT"DO YOU WANT TO S
```

```
EE THE LINE?":INPUT A1$:IF LEFT$(A1$,1)<>"Y" THEN 3040
3010 CLOSE 1:OPEN"I",1,A2$
3020 FOR X%=10 TO B STEP 10:LINE INPUT#1,C$:GOSUB 4100
3022 IF VAL(N3$)=C THEN 3030
3025 NEXT
3030 PRINTC$
3040 RETURN
3100 ED=1:E$=STR$(D)+" /"+D$:D$="":C$=""
3110 PRINT #2,E$:Z=Z+1:E$="":D=0:C=0:RETURN
3120 K1$=C$:GOSUB 4000:C$=RIGHT$(K1$,LEN(K1$)-L5):E$=STR$(D)+" /"+C$:C$=
""
3130 PRINT #2,E$:E$="":C=0:D=0:RETURN
3950 FOR Z%=1 TO Z-1
3955 FOR Y%=1 TO Z-Z%
3960 IF CH(Y%,0)<CH(Y%+1,0) THEN 3975
3962 IF CH(Y%,0)=CH(Y%+1,0) AND CH(Y%,0)<>0 THEN CH(Y%,0)=0:CH(Y%,1)=0:G
OTO 3950
3965 SWAP CH(Y%,0),CH(Y%+1,0)
3966 SWAP CH(Y%,1),CH(Y%+1,1)
3975 NEXT Y%
3976 NEXT Z%
3985 RETURN
4000 L5=0:FOR Y%=1 TO 8
4005 F$=MID$(K1$,Y%,1)
4010 IF F$="/" THEN L5=L5+1:GOTO 4035
4015 L5=L5+1
4030 NEXT
4035 RETURN
4100 N3$="":FOR Y%=1 TO 10
4110 IF MID$(C$,Y%,1)=>"0" AND MID$(C$,Y%,1)<="9" THEN N3$=N3$+MID$(C$,Y
%,1):GOTO 4140
4120 IF MID$(C$,Y%,1)=CHR$(32)THEN 4140
4130 RETURN
4140 NEXT:RETURN
5000 IF P1=1 THEN PRINT TAB(39);"(";P2;")":L1=L1+1:P2=P2+1
5010 IF T=1 THEN PRINT TAB(8);T$:L1=L1+1
5020 IF T1$<>""THEN PRINT TAB(8);T1$:L1=L1+1
5030 IF D=0 THEN PRINT:L1=L1+1
5040 IF D=1 THEN PRINT:PRINT:L1=L1+2
5050 RETURN
5060 PRINT"FIRST LINE?":INPUT C1:ED=1
5070 PRINT"LAST LINE?":INPUT C2
5080 PRINT"FIRST NEW LINE? (BETWEEN ALREADY USED LINES)":INPUT DL:DL=DL-
1
5090 FOR X%=C1 TO C2 STEP 10
5100 DL=DL+1:IF DL/10=INT(DL/10) THEN PRINT"MOVE ABORTED DUE TO LACK OF
ROOM TO RECEIVE LINE AT";DL;" MOVE HALTED AT LINE";X%:GOTO 270
5110 Z=Z+1:CH(Z,0)=X%:CH(Z,1)=1:Z=Z+1:CH(Z,0)=DL
5115 PRINT"MOVED LINE ";:D=DL:C=X%:GOSUB 3010:GOSUB 3120
5120 NEXT:PRINT"COMPLETED MOVE":GOTO 270
5130 PRINT"FIRST LINE?":INPUT C1:ED=1
5140 PRINT"LAST LINE?":INPUT C2
5150 FOR X%=C1 TO C2 STEP 10
5160 Z=Z+1:CH(Z,0)=X%:CH(Z,1)=2:PRINT"DELETED LINE";X%
5170 NEXT:PRINT"COMPLETED DELETIONS":GOTO 270
6000 ED=1:PRINT"WHAT IS THE LINE NUMBER?":INPUT C:D=C:Z=Z+1:CH(Z,0)=C:
     GOSUB 3010:Z4=LEN(C$):LE=1:D$="":Z1$=""
6010 GOSUB 6500
6020 IF Z$=" "THEN 6130
6030 IF Z$=>"1"AND Z$<="9"THEN 6150
6040 IF Z$="C" OR Z$="c" THEN 6170
6050 IF Z$="D" OR Z$="d"THEN 6180
6060 IF Z$="L" OR Z$="l"THEN 6230
```

```
6070 IF Z$="Q" OR Z$="q"THEN 6260
6080 IF Z$="I" OR Z$="i" THEN 6270
6090 IF Z$="X" OR Z$="x" THEN 6290
6100 IF Z$="H" OR Z$="h"THEN 6320
6110 IF Z$=CHR$(13) THEN 6330
6120 PRINT CHR$(7)::GOTO 6010
6130 IF LE>Z4 THEN 6120
6140 PRINT MID$(C$,LE,1);:D$=D$+MID$(C$,LE,1):LE=LE+1:GOTO 6010
6150 IF Z1$<>""THEN Z1$=Z1$+Z$ ELSE Z1$=Z$
6160 GOTO 6010
6170 IF Z1$=""THEN 6174
6171 FOR Z2%=LE TO LE+VAL(Z1$)-1
6172 GOSUB 6500:PRINT Z$;:D$=D$+Z$
6173 NEXT:LE=Z2%:Z1$="":GOTO 6010
6174 GOSUB 6500:PRINT Z$;:LE=LE+1:D$=D$+Z$:GOTO 6010
6180 IF Z1$=""THEN 6220
6190 PRINT"\";:FOR Z2%=LE TO LE+VAL(Z1$)-1
6200 PRINT MID$(C$,Z2%,1);:NEXT
6210 PRINT"\";:LE=Z2%:Z1$="":GOTO 6010
6220 PRINT"\";:PRINT MID$(C$,LE,1);:PRINT"\";:LE=LE+1:GOTO 6010
6230 FOR Z2%=LE TO Z4
6240 PRINT MID$(C$,Z2%,1);:D$=D$+MID$(C$,Z2%,1)
6240 PRINT MID$(C$,Z2%,1);:D$=D$+MID$(C$,Z2%,1)
6250 NEXT:C$=D$:D$="":PRINT:Z4=LEN(C$):LE=1:GOTO 6010
6260 PRINT:D$="":GOTO 270
6270 GOSUB 6500
6272 IF Z$=CHR$(127)THEN 6370
6274 IF Z$=CHR$(27)THEN 6010
6275 IF Z$=CHR$(13)THEN 6330
6280 PRINT Z$;:D$=D$+Z$:GOTO 6270
6290 FOR Z2%=LE TO Z4
6300 PRINT MID$(C$,Z2%,1);:D$=D$+MID$(C$,Z2%,1)
6310 NEXT:LE=Z4:GOTO 6270
6320 Z4=LE:GOTO 6270
6330 IF LE=>Z4 THEN PRINT CHR$(13):D$=D$+CHR$(13):C$=D$:GOSUB 3120:GOTO
270
6340 FOR Z2%=LE TO Z4
6350 PRINT MID$(C$,Z2%,1);:D$=D$+MID$(C$,Z2%,1)
6360 NEXT:PRINT CHR$(13):D$=D$+CHR$(13):C$=D$:GOSUB 3120:GOTO 270
6370 PRINT"\";
6380 PRINT MID$(D$,LEN(D$),1);:D$=LEFT$(D$,LEN(D$)-1)
6390 GOSUB 6500:IF Z$=CHR$(127)THEN 6380
6400 PRINT"\";:GOTO 6274
6500 WAIT 0,&O1,&O1
6510 Z2=INP(1)AND&O177:Z$=CHR$(Z2):RETURN
OK
```

MEDICAL ACCOUNTS

INTRODUCTION

In this second article in the microbusiness series, I attempt briefly to present the technical and economic merits of using microcomputers in small business by describing one example of how a typical accounting function may be implemented on a small system. This article extends the general concepts developed in my previous article* by delving into the functional details of the various programs which make up a single accounting operation.

If there is one aspect of an on-going small business which must be handled effectively, accurately and expeditiously, it is Accounts Receivable. Failure to devise an appropriate system (manual or automated) to handle this function, invariably results in temporary disaster or complete failure of an otherwise successful enterprise. Historically, automation of this particular facet of a business has been a logical beginning for many "Big Boy" companies. Therefore, one would expect it to appeal to the small businessman and all who are attempting to bring order and understanding to what is commonly viewed as chaos. With the advent of low-cost microprocessors and a few zealous programmers it is now eminently feasible to automate all business accounting functions, including Receivables, with an in-house system.

Although all business entities face a Receivables problem sometime in their existence, medical and dental enterprises appear to be plagued with severe problems as soon as they hang out their shingles. This cash-intensive and consumer-oriented business appeared to offer a reasonable probability of commercial success for us, so it was to this market that A.S.I. addressed its first microprocessor efforts in early 1975. Of course, we had first to write our compiler/interpreter, OPUS. The resulting logical design and programs which make up the complete package are summarized in the paragraphs that follow.

MEDICAL ACCOUNTS RECEIVABLE

The A.S.I. Medical Accounts Receivable package to be discussed consists of approximately 17 main programs, 54 sub-programs, and 21 files. Together they provide the business manager with a flexible method of monitoring and controlling his revenue. The package accepts on-line transaction of information based on patient charges and payments and produces bills, insurance claims, and a host of management reports which reflect an accurate and timely status of the services performed, charges recorded, and payments received. A system with two floppy discs executes combinations of open-item, balance forward, contracts, and insurance accounts for up to 1,400 active patients and clients. An unlimited number of different reports may be generated from the data files by providing both standard and pre-formatted output reports, as well as a user-defined

RECEIVABLE PACKAGE

By M. R. Lockwood, A.S.I.
Denver, CO

report generating program (QUERY).

This package has been running since March of 1976 on a MITS 8800A with 32K bytes of memory, dual floppy discs, a CRT, and an LA-36 printer. This bulk storage capacity allows up to 1,400 active patients on-line with up to 5,000 open transactions. Individual programs are called in from the disc one at a time by the user, allowing maximum utilization of the small main memory. All programs are written in A.S.I.'s OPUS, a very powerful high-level language. The modularity of the software package allows very simple expansion of both quantity of patients and quantity of terminals (users). With A.S.I.'s newly announced Multi-User/Multi-Tasking Operating System (TEMPOS), it is now possible to have up to seven users (CRTs and/or printers) operating simultaneously.

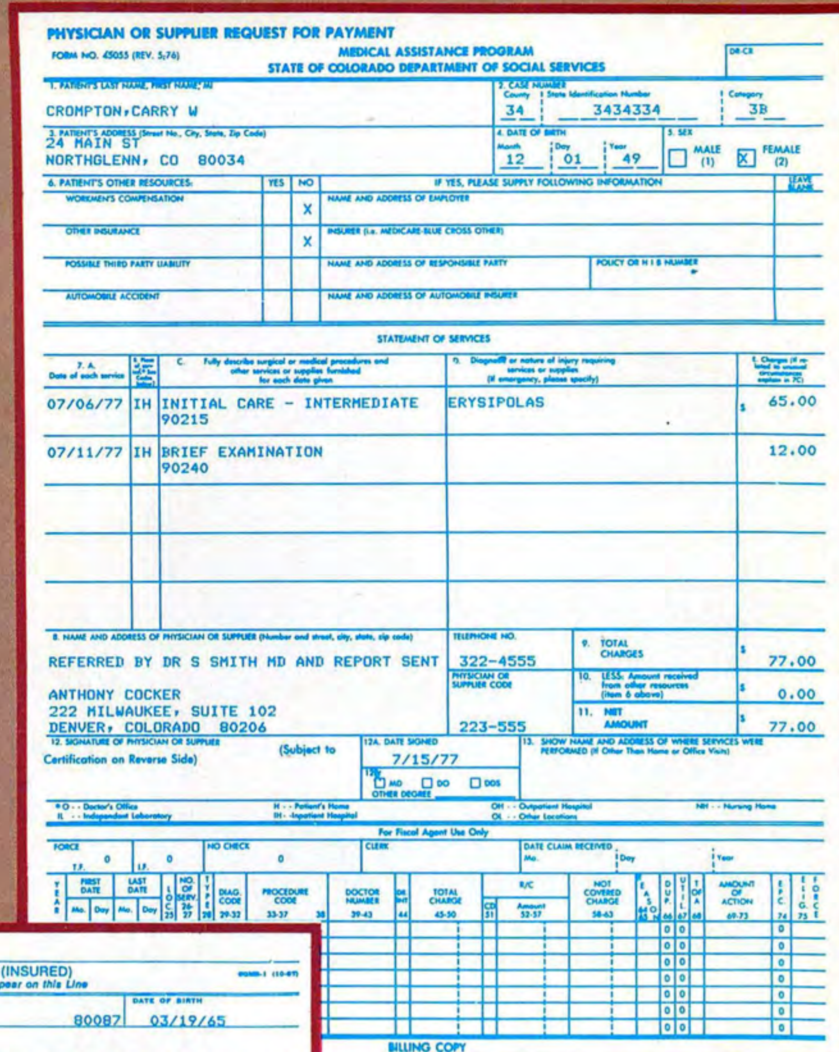
BENEFIT OBJECTIVES

Some of the many benefits to be derived from an automated Accounts Receivable system are:

- Prompt and accurate billing
- Prompt and accurate recording of charges, payments, and adjustments
- Automated insurance claims
- Instantaneous response to patient inquiries
- Accurate and timely maintenance of account status
- Increased collections and reduced aging
- Monitoring of services performed, by the providing physician
- Simple and efficient retrieval of diagnostic information

The programs making up the receivable package fulfill those worthy objectives in a convenient, non-technical and economic manner. These programs are divided into input, output and utility programs. It is not possible to describe in this brief article all the various functions performed by each program; however, we hope we can supply enough information in order to convey a general understanding of the overall package. All programs are disc-resident and are called into memory as a result of user response to system prompts. With this design philosophy, it is possible to implement a large software package on a very economical hardware configuration, even though an interpreter is required to be memory-resident. Each program operates in a highly interactive manner. By this, we mean that the computer presents guidance and optional selection information to the user in simple English prompts, and the user replies indicating his selection or directive. This type of interaction between the computer and the user continues until the objectives of the user are completed (i.e., prepare a report, enter a customer's payment, etc.). Most programs present sufficient visual information to the user to permit a person unfamiliar with the computer system to operate it effectively. *Under no circumstances must the user be a skilled programmer.*

*Micro Business — Introduction to Accounting Programs in Small Microcomputer Systems by Mal R. Lockwood, A.S.I., *INTERFACE AGE*, September 1976.



PHYSICIAN OR SUPPLIER REQUEST FOR PAYMENT

FORM NO. 45055 (REV. 5/76) — MEDICAL ASSISTANCE PROGRAM — STATE OF COLORADO DEPARTMENT OF SOCIAL SERVICES

1. PATIENT'S LAST NAME, FIRST NAME, MI: CROMPTON, CARRY W
2. CASE NUMBER: County 34 — State Identification Number 3434334 — Category 3B
3. PATIENT'S ADDRESS (Street No., City, State, Zip Code): 24 MAIN ST, NORTHGLENN, CO 80034
4. DATE OF BIRTH: Month 12, Day 01, Year 49
5. SEX: MALE (1) ☐ FEMALE (2) ☒

6. PATIENT'S OTHER RESOURCES — IF YES, PLEASE SUPPLY FOLLOWING INFORMATION

	YES	NO	
WORKMEN'S COMPENSATION		X	NAME AND ADDRESS OF EMPLOYER
OTHER INSURANCE		X	INSURER (i.e. MEDICARE-BLUE CROSS OTHER)
POSSIBLE THIRD PARTY LIABILITY			NAME AND ADDRESS OF RESPONSIBLE PARTY — POLICY OR H I B NUMBER
AUTOMOBILE ACCIDENT			NAME AND ADDRESS OF AUTOMOBILE INSURER

STATEMENT OF SERVICES

7. A. Date of each service	B. Place	C. Fully describe surgical or medical procedures and other services or supplies furnished for each date given	D. Diagnosis or nature of injury requiring services or supplies (if emergency, please specify)	E. Charges
07/06/77	IH	INITIAL CARE - INTERMEDIATE 90215	ERYSIPOLAS	$ 65.00
07/11/77	IH	BRIEF EXAMINATION 90240		12.00

8. NAME AND ADDRESS OF PHYSICIAN OR SUPPLIER: REFERRED BY DR S SMITH MD AND REPORT SENT — ANTHONY COCKER, 222 MILWAUKEE, SUITE 102, DENVER, COLORADO 80206
TELEPHONE NO. 322-4555 — PHYSICIAN OR SUPPLIER CODE 223-555
9. TOTAL CHARGES $ 77.00
10. LESS: Amount received from other resources (Item 6 above) $ 0.00
11. NET AMOUNT $ 77.00
12. SIGNATURE OF PHYSICIAN OR SUPPLIER (Subject to Certification on Reverse Side)
12A. DATE SIGNED 7/15/77
☐ MD ☐ DO ☐ DDS OTHER DEGREE
13. SHOW NAME AND ADDRESS OF WHERE SERVICES WERE PERFORMED (If Other Than Home or Office Visits)

O - Doctor's Office; IL - Independent Laboratory; H - Patient's Home; IH - Inpatient Hospital; OH - Outpatient Hospital; OL - Other Locations; NH - Nursing Home

For Fiscal Agent Use Only

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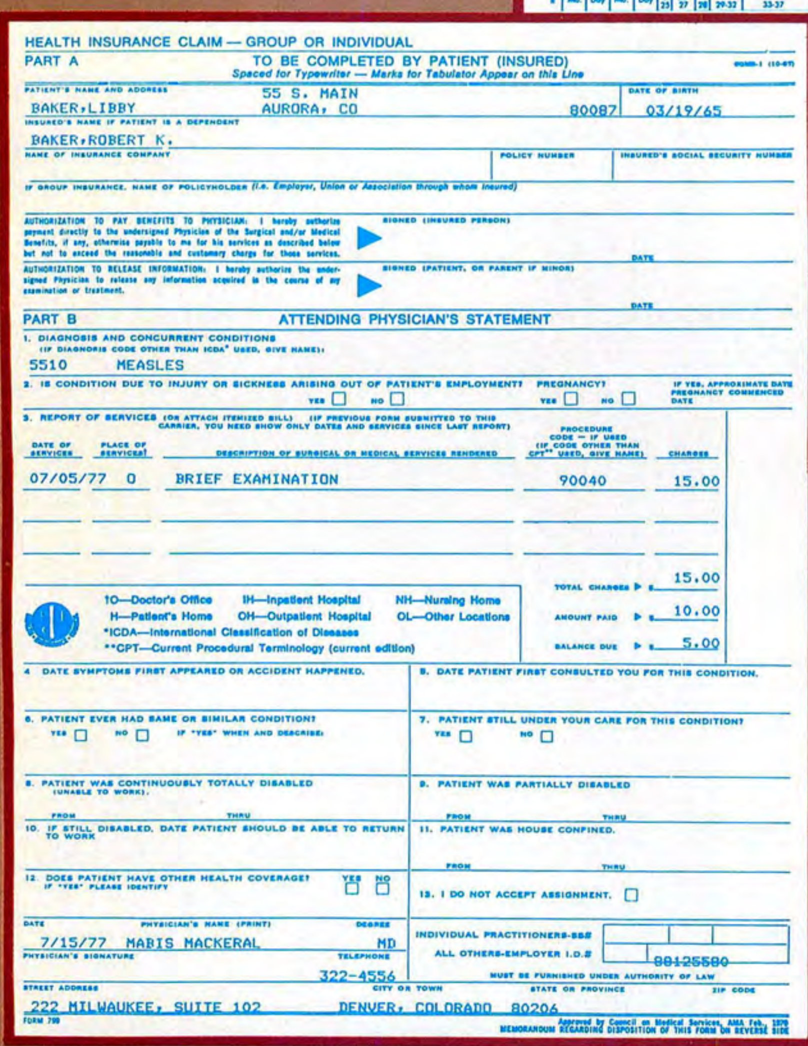

HEALTH INSURANCE CLAIM — GROUP OR INDIVIDUAL

PART A — TO BE COMPLETED BY PATIENT (INSURED)
Spaced for Typewriter — Marks for Tabulator Appear on this Line

PATIENT'S NAME AND ADDRESS: BAKER, LIBBY — 55 S. MAIN, AURORA, CO 80087 — DATE OF BIRTH 03/19/65
INSURED'S NAME IF PATIENT IS A DEPENDENT: BAKER, ROBERT K.
NAME OF INSURANCE COMPANY — POLICY NUMBER — INSURED'S SOCIAL SECURITY NUMBER
IF GROUP INSURANCE, NAME OF POLICYHOLDER (i.e. Employer, Union or Association through whom insured)

AUTHORIZATION TO PAY BENEFITS TO PHYSICIAN: I hereby authorize payment directly to the undersigned Physician of the Surgical and/or Medical Benefits, if any, otherwise payable to me for his services as described below but not to exceed the reasonable and customary charge for those services. SIGNED (INSURED PERSON) DATE

AUTHORIZATION TO RELEASE INFORMATION: I hereby authorize the undersigned Physician to release any information acquired in the course of my examination or treatment. SIGNED (PATIENT, OR PARENT IF MINOR) DATE

PART B — ATTENDING PHYSICIAN'S STATEMENT

1. DIAGNOSIS AND CONCURRENT CONDITIONS (IF DIAGNOSIS CODE OTHER THAN ICDA* USED, GIVE NAME): 5510 MEASLES
2. IS CONDITION DUE TO INJURY OR SICKNESS ARISING OUT OF PATIENT'S EMPLOYMENT? YES ☐ NO ☐ — PREGNANCY? YES ☐ NO ☐ — IF YES, APPROXIMATE DATE PREGNANCY COMMENCED
3. REPORT OF SERVICES (OR ATTACH ITEMIZED BILL) (IF PREVIOUS FORM SUBMITTED TO THIS CARRIER, YOU NEED SHOW ONLY DATES AND SERVICES SINCE LAST REPORT)

DATE OF SERVICES	PLACE OF SERVICE†	DESCRIPTION OF SURGICAL OR MEDICAL SERVICES RENDERED	PROCEDURE CODE — IF USED (IF CODE OTHER THAN CPT** USED, GIVE NAME)	CHARGES
07/05/77	O	BRIEF EXAMINATION	90040	15.00

TOTAL CHARGES $ 15.00
AMOUNT PAID $ 10.00
BALANCE DUE $ 5.00

†O—Doctor's Office; IH—Inpatient Hospital; NH—Nursing Home; H—Patient's Home; OH—Outpatient Hospital; OL—Other Locations
*ICDA—International Classification of Diseases
**CPT—Current Procedural Terminology (current edition)

4. DATE SYMPTOMS FIRST APPEARED OR ACCIDENT HAPPENED.
5. DATE PATIENT FIRST CONSULTED YOU FOR THIS CONDITION.
6. PATIENT EVER HAD SAME OR SIMILAR CONDITION? YES ☐ NO ☐ IF "YES" WHEN AND DESCRIBE:
7. PATIENT STILL UNDER YOUR CARE FOR THIS CONDITION? YES ☐ NO ☐
8. PATIENT WAS CONTINUOUSLY TOTALLY DISABLED (UNABLE TO WORK). FROM THRU
9. PATIENT WAS PARTIALLY DISABLED FROM THRU
10. IF STILL DISABLED, DATE PATIENT SHOULD BE ABLE TO RETURN TO WORK
11. PATIENT WAS HOUSE CONFINED. FROM THRU
12. DOES PATIENT HAVE OTHER HEALTH COVERAGE? IF "YES" PLEASE IDENTIFY YES ☐ NO ☐
13. I DO NOT ACCEPT ASSIGNMENT. ☐

DATE 7/15/77 — PHYSICIAN'S NAME (PRINT) MABIS MACKERAL — DEGREE MD
PHYSICIAN'S SIGNATURE — TELEPHONE 322-4556
INDIVIDUAL PRACTITIONERS-SS# — ALL OTHERS-EMPLOYER I.D.# 98125580
MUST BE FURNISHED UNDER AUTHORITY OF LAW
STREET ADDRESS 222 MILWAUKEE, SUITE 102 — CITY OR TOWN DENVER, COLORADO — ZIP CODE 80206
FORM 799 — Approved by Council on Medical Services, AMA Feb. 1970 — MEMORANDUM REGARDING DISPOSITION OF THIS FORM ON REVERSE SIDE

Figures 1a and 1b. INSURANCE FORMS This is one of the insurance forms produced by the INSURance Program. This program keeps track of, and outputs all the demographic and service information for, an insurance-type patient such as name, address, employee ID number, doctor assigned to the case, doctor's degree and physician code, referring physician, diagnosis, procedure description, place of service, charges, etc. This program is made up of several subroutines, enabling easy modification for different forms.

An overview of the main programs which a user normally confronts are:

CODE	Add, change, delete, list program for all codes
EDIT	General add, change, delete, list program for all account data
UPDATE	Links transaction data; accumulates month-to-date and year-to-date figures; sorts accounts alphabeticaly, by zip code, or by payment type; ages accounts; clears files at end of month or end of year; closes accounts to balance forward
YTD	Creates a year-to-date copy of all account transactions, to be used for analytical purposes
DAILY	Lists all new accounts, new cases, and new transactions following the last run of UPDATE. Also gives the physician a payment type analysis.
LEDGER	Generate all or partial account data for one or all accounts
ACCT#	Lists all accounts, giving the account number and name
NUMBER	Finds the account number for a given name
QUERY	Generates a user-defined report, selecting specific data and listing specific data
TOTAL	Generates total numbers and amounts for user-selected accounts
LABEL	Generates mailing labels for selected accounts
AGING	Gives the aging analysis by payment type
SERVICE	Gives the service analysis by physician and transaction code
COLLEC	Gives the collection analysis for each month and year-to-date
DELINQ	Gives a report of all delinquent accounts
BILLS	Generates statements for all appropriate accounts
INSUR	Generates insurance forms for a given payment type

INPUT PROGRAMS

Of the above programs, data entry is accomplished through EDIT and CODE. The remaining programs produce output or are utility functions.

EDIT and CODE execute as follows:

1. The computer requests a response to the item prompt.
2. If the user enters a valid response, the computer will proceed to the next prompt.

NEUROLOGICAL CONSULTANTS, A.P.C.
4545 E 9TH AVE. SUITE 650
DENVER, COLORADO 80220

STATEMENT

5/1/77
48218

HAROLD S JENNISON
BOX 56
HEALY, KS 67850

PLEASE RETURN TOP PORTION WITH REMITTANCE - KEEP BOTTOM FOR YOUR RECORDS

DATE	DR	PAT	SERVICE	CHARGE	CREDIT	BALANCE
03/15/77	SG	YJ	BALANCE BROUGHT FORWARD	140.00	0.00	140.00
03/29/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	155.00
03/30/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	170.00
03/31/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	185.00
04/01/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	200.00
04/02/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	215.00
04/03/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	230.00
04/04/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	245.00
04/05/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	260.00
04/06/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	275.00
04/07/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	290.00
04/08/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	305.00
04/09/77	SG	YJ	HOSP ADMISSION TRTMT &	15.00	0.00	320.00

CONTINUED ON ADDITIONAL STATEMENT

NEUROLOGICAL CONSULTANTS, A.P.C.

Figure 2. STATEMENTS
Typical bill or statement produced by BILLS Program. This is usually a multi-part form providing a top sheet for internal use, an envelope for mailing to the patient and a pre-printed return envelope allowing the patient to mail in his check with the minimum of effort.

3. If the user enters an invalid response, the computer will inform the user of the mistake and request the item again.
4. If the user enters a carriage return to the prompt, the computer will return to the previous item prompt. If there was no previous item, the program will be terminated (The computer returns to "PROGRAM?").

A data entry program will normally request the following information:

1. The name of the file that is to be changed.
2. The option, i.e., that which is to be done to the file. The possibilities are as follows:

   ADD: New information is to be entered to the file. For every piece of information (called an attribute), there will be a default value, which will be entered into the file if the user simply hits the return key in response to the attribute prompt. It is possible that some attributes absolutely require user input, in which case a default value is not allowed.

   CHANGE: Data previously entered is to be changed. The program will always print out the current value of the attribute and then request the

CHARGES & RECEIPTS REPORT — PAGE 1

JUL 15, 1977

NO	DATE	ACCT#	FRP NAME	CASE#	PAT	TYPE	DR	DIAG	TRAN	CHARGE	RECEIPT	CUR BAL
1	07/01/77	10014	AMES,ANDREW	1	AA	1	3	3210	12.5	12.50	0.00	48.00
2	07/07/77	10010	NEUMANN,SILVIA	1	SN	5	2	3610	90170	50.00	0.00	70.60
3	07/07/77	10041	PATTERSON,PATRICIA	1	JP	5	2	3410	90230	244.00	0.00	30.00
6	07/10/77	10014	AMES,ANDREW	1	AA	1	3	3210	1	0.00	20.00	48.00
7	07/10/77	10014	AMES,ANDREW	1	AA	1	3	3210	90170	30.00	0.00	48.00
9	07/10/77	10001	ANDERSON,SAMUEL	1	SA	2	2	110	90030	10.00	0.00	0.00
11	07/10/77	10008	BACON,FRANK	1	ED	3	3	3310	90060	25.00	0.00	49.00

Figure 3. CHARGES AND RECEIPTS
Shows in entry order, the date of service, patient treated (PAT), the party financially responsible (FRP) and their assigned account number, case number, payment type (type 2 is Cash, type 3 is Blue Cross, etc.), who provided the treatment (DR), the doctor's diagnosis, the type of treatment provided (TRAN), the amount to be billed (CHARGE), amount paid (RECEIPT), and the current balance of the total account.

NEW ACCOUNTS

JUL 15, 1977

NO	ACCOUNT	NAME	ADDRESS	TELEPHONE	ACCT CTRL	TYPE
37	10070	DIGBY,DORIS E	567 S. HAMPSHIRE ROAD NORTHGLENN, CO 80033	303 422-4511	0	6
40	10071	TREMOR,DANIEL W	245 MILWAUKEE DENVER, CO 80206	303 321-6690	0	3

Figure 4. NEW ACCOUNTS
Lists all new accounts that were entered into the system since UPDATE program was last run. Here the account number, name, address and phone number of the financially responsible party (FRP) is printed together with an account control code and payment type code applied to this account. The control code allows such action as "DO NOT BILL," "HOLD BILL FOR PICK-UP AT OFFICE," etc. Payment type is the method by which the FRP agrees to pay, i.e., cash, contract, insurance, etc.

NEW CASES

JUL 15, 1977

NO	ACCT#	FRP NAME	CASE#	PAT	TYPE	DR	DIAG	HOLD
8	10001	ANDERSON,SAMUEL	1	SA	2	2	110	N
38	10070	DIGBY,DORIS E	1	SD	6	3	5210	N
41	10071	TREMOR,DANIEL W	1	DT	3	2	3410	N

Figure 5. NEW CASES
Lists all new cases which were set up since UPDATE was last run (a case is a file of transactions which have all of the following things in common: doctor, patient, payment type, and diagnosis). HOLD (yes or no) operates as a flag to the INSURance program so that all cases which are tagged with Y (yes) are NOT printed on insurance forms.

DOCTORS' CHARGES, RECEIPTS/ADJ REPORT

JUL 15, 1977

DOCTOR	DAY		MONTH		YEAR	
	CHARGES	RECEIPTS/NET ADJ	CHARGES	RECEIPTS/NET ADJ	CHARGES	RECEIPTS/NET ADJ
1	156.00	168.00	695.00	-392.70	695.00	-392.70
2	519.00	0.00	664.00	-360.60	664.00	-360.60
3	234.50	800.00	538.50	-1275.45	538.50	-1275.45
TOTALS	909.50	968.00	1897.50	-2028.75	1897.50	-2028.75

Figure 6. DOCTORS' CHARGES, RECEIPTS/ADJ REPORT
Breaks down, by doctor, the charges and receipts transacted since UPDATE was run. This is a revealing report since it shows vividly which doctors in the organization are generating income for the group.

METHOD OF PAYMENT REPORT

JUL 15, 1977

TYPE	DAY		MONTH		YEAR	
	CHARGES	RECEIPTS/NET ADJ	CHARGES	RECEIPTS/NET ADJ	CHARGES	RECEIPTS/NET ADJ
1	142.50	130.00	269.50	14.22	269.50	14.22
2	87.00	750.00	253.00	-1185.00	253.00	-1185.00
3	40.00	13.00	163.00	-177.00	163.00	-177.00
4	59.00	75.00	179.00	-559.37	179.00	-559.37
5	409.00	0.00	601.00	-108.60	601.00	-108.60
6	172.00	0.00	432.00	-13.00	432.00	-13.00
TOTALS	909.50	968.00	1897.50	-2028.75	1897.50	-2028.75

Figure 7. METHOD OF PAYMENT REPORT
Takes the same data as in 4 and sorts it by payment type; e.g., shows which portions of their income are coming from cash and which from insurance companies.

ACCOUNTS RECEIVABLE AGING
JUL 15, 1977

TYPE	ACCT#	NAME	LAST PAYMT	LAST PAY	PAY YTD	BALANCE	CURRENT	30 DAY	60 DAY	90 DAY	120/OVER
1	10014	AMES,ANDREW	07/10/77	20.00	20.00	58.00	58.00	0.00	0.00	0.00	0.00
1	10001	ANDERSON,SAMUEL	/ /	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	10050	DRAKE,TERRENCE C	07/12/77	100.00	100.00	66.33	66.33	0.00	0.00	0.00	0.00
1	10040	GADSBY,MARY J	/ /	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	10017	HABERSTON,KATHERINE L	07/12/77	10.00	10.00	18.45	18.45	0.00	0.00	0.00	0.00
1	10007	LINSTROM,LINDA	/ /	0.00	0.00	65.00	65.00	0.00	0.00	0.00	0.00
1	10011	OPPENHEIMER,SAM	/ /	0.00	0.00	25.00	25.00	0.00	0.00	0.00	0.00
1	10005	RIDDLE JR.,JAMES S.	/ /	0.00	0.00	10.00	10.00	0.00	0.00	0.00	0.00
		SUBTOTAL			130.00	242.78	242.78	0.00	0.00	0.00	0.00
						100.0%	100.0%	0.0%	0.0%	0.0%	0.0%

Figure 8. ACCOUNTS RECEIVABLE AGING
This output report from the AGING program lists by type of payment (1 is Cash, 5 is Medicare, etc.) the status of each account, showing such things as when and how much was last paid, total paid year-to-date (YTD), the balance of the account, and whether that balance is current or past due 30, 60, 90 or 120 days. Report 7 shows accounts which have been sorted for a different payment type than report 6.

corrected value. The user should type either in this value or just hit the return key if no change is to be made after all. Some attributes may not be changed if their current value affects other files.

DELETE: Data previously entered is to be deleted from the file. As in the change restriction, some file records may not be deleted if other files depend on the contents of this record.

LIST: Lists all attribute values in a record. This may be used to determine what is in the record.

3. The record. A record may be requested either by entering the record identification number if one exists, or by the computer scanning the current records in the file and asking the user if each record is the desired one. In the latter case, the user must respond with a "Y" (YES) or "N" (NO). The default value (carriage return) is assumed to be "N."
4. The attributes. For each record, there will be one or more attributes that are to be edited.

CODE

This program is used to add, change, or list all codes. Codes must be assigned to various attributes pertaining to account data. These codes are initially entered in this program to inform the computer exactly what the valid codes are. Descriptions and other information may be requested to be used in output reports. In the account entry program (EDIT) the user must use these codes to specify the correct attribute value.

The following codes are typically required: transaction category codes, transaction codes (service, payment, and adjustment), diagnostic codes, doctor codes, payment type codes, special message codes, and mass message codes.

Codes may not be deleted because they are in constant use by the accounts. If a code becomes obsolete, either the description may be changed or the code may be ignored altogether.

EDIT

This data entry program will be used to enter, change, delete, and list all data pertaining to an account. This includes financially responsible party, payment type, patient, case, service, payment and adjustment information.

'Financially Responsible Party' (FRP) is the name of the file containing all the information concerning the principal of the account; 'Payment type' (T) is a file containing the type of payment an FRP normally makes, i.e., cash, Blue Cross/Blue Shield, Medicare, etc. 'Patient' (P) is a file containing basic information about a patient, primarily used for insurance forms. 'Case' (C) is a file containing transactions which have all of the following attributes in common: same patient, same FRP, same diagnosis, and same physician. (This allows a separate insurance form to be printed for each separate case.) 'Service' (S) is a file containing the service rendered, the amount charged, the place of service, and the date. 'Payment/Adjustment' (A) is a file which holds all received payments plus records any charge adjustments for each account.

OUTPUT PROGRAMS

After the data entry programs are used to enter all the pertinent information into the files, the user may call for a DAILY report summarizing new accounts, cases, or transactions entered, plus reports concerning charges/receipts by doctor or by payment type (insurance, cash, etc.). Insurance claims may be prepared at this time also. We recommend that a copy be made of the daily discs for back-up purposes; then the UPDATE program should be run. UPDATE takes the temporary daily file information and enters this into the permanent files, calculates monthly and year-to-date quantities, and sorts the files alphabetically and/or by payment type. Once this is accomplished the user may obtain any of the many management reports which utilize this up-to-date information, such as: Aging Analysis, Collections Analysis, Delinquency Report, Service Analysis, ledger reports, TOTAL or QUERY. At the end of the accounting period all patient statements (bills) may be prepared. An option in the UPDATE program allows all accounts to be sorted by zip code if desired, facilitating bulk mailing. Finally, an archival copy of the current month-end data is transferred to the year-to-date discs, providing long-term record retention.

In addition to standard preformatted output reports, we provide a powerful data base sorter and report generator named QUERY. This program allows the user to define his own selection criteria in a logical manner and, furthermore, lets him format his output report to his choosing. With this program the overall package may be customized by the user himself with very simple and straightforward procedures. If the user finds himself selecting the same information through QUERY, over and over again, the TEMPOS Operating System provides a simple method of letting him enter the input selection criteria and output formatting instructions into a 'Command Macro'. Once this Macro is named and saved, it may be reused at will by simply calling it. After entering the QUERY program with this technique, we allow the user actually to program the system without ever having to learn anything about computer programming. This ensures that the system will grow as the user's business environment and needs grow, and allows the user to derive the maximum benefits of an electronic data base.

In conclusion, I trust that I have supplied sufficient information to demonstrate that a microprocessor does indeed provide a low-cost, simple, yet powerful, solution to the ever present accounting problems faced by all small professional organizations. I hope it is now obvious that with this new tool, it is possible today for a small businessman to gain immediate access to the same accounting information as the "Big-Boy", and with this new tool, many controls and much planning, the small businessman may even grow to be a "Big-Boy." At least he will have available to him all the tools necessary to effect this growth.

INTERFACE AGE

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COLLECTION ANALYSIS

JUL 15, 1977

MO	ACCNTS RECEIVABLE VALUE			NO OF STATEMENT			CURRENT MONTH				CURRENT PAYMENTS BY ACCOUNT AGE				
	TOTAL	DELNQNT	%	NO	DELQ	%	CHARGES	PAYMENTS	%	NET ADJ	CURRENT	30 DAYS	60 DAYS	90 DAYS	120/OVER
7	3649.75	0.00	0.0%	0	0	0.0%	1641.00	978.00	59.5%	2986.75	978.00 100.0%	0.00 0.0%	0.00 0.0%	0.00 0.0%	0.00 0.0%
YEAR TO DATE TOTALS				0	0	0.0%	1641.00	978.00	59.5%	2986.75	978.00 100.0%	0.00 0.0%	0.00 0.0%	0.00 0.0%	0.00 0.0%

Figure 9. COLLECTION ANALYSIS
This report identifies how well the organization collects its Receivables. It shows the total outstanding receivables due, the amount, number and percent of total which is delinquent, number of statements sent this month, the charges generated this month, the payments received, and the percentage these payments represent of the charges, plus the net adjustments applied to the receivable this month. Also, the status of the collected monies is shown, i.e., current or 30, 60, 90, or 120 days old. Year-to-date percentages and amounts are totaled at the bottom of the report.

DELINQUENCY REPORT

JUL 15, 1977

TYPE	ACCT#	NAME & ADDRESS	TELEPHONE	BALANCE	DELINQUENT	LAST PAYMT	LAST PAY $	COMMENTS
1	10050	DRAKE,TERRENCE C 777 S. MAPLE AVE. DENVER, CO 80010	303 333-4467	91.33	25.00	07/12/77	100.00	
1	10007	LINSTROM,LINDA 7222 N. BROADWAY DENVER, CO 80020	303 325-4433	115.00	50.00	00/00/00	0.00	

Figure 10. DELINQUENCY REPORT
This report lists all accounts by payment type which are determined to be delinquent. All the information enabling the collection function to be performed is provided, including phone number, when they last paid on the account, and the amount due.

ANALYSIS OF SERVICES: TOTALS

JUL 15, 1977

SVCOD	DESCRIPTION	CURRENT MONTH TRANSACTIONS					YEAR-TO-DATE TRANSACTIONS				
		NUMBER	% TTL#	AVE AMT	TOTAL AMT	% TTL$	NUMBER	% TTL#	AVE AMT	TOTAL AMT	% TTL$
OFFICE VISITS											
90030	MINIMAL SERVICE	4	14.28	22.00	88.00	12.07	4	14.28	22.00	88.00	12.07
90040	BRIEF EXAMINATION	11	39.28	15.00	165.00	22.63	11	39.28	15.00	165.00	22.63
90050	LIMITED EXAMINATION	3	10.71	30.00	90.00	12.34	3	10.71	30.00	90.00	12.34
90060	INTERMEDIATE EXAMINATION	6	21.42	33.16	199.00	27.29	6	21.42	33.16	199.00	27.29
90070	EXTENDED RE-EXAMINATION	2	7.14	28.50	57.00	7.81	2	7.14	28.50	57.00	7.81
90080	COMPREHENSIVE RE-EXAM	2	7.14	65.00	130.00	17.83	2	7.14	65.00	130.00	17.83
TOTAL		28	100.00	26.03	729.00	100.00	28	100.00	26.03	729.00	100.00
HOME VISITS											
90130	MINIMAL SERVICE	1	12.50	56.00	56.00	16.51	1	12.50	56.00	56.00	16.51
90140	BRIEF EXAMINATION	1	12.50	25.00	25.00	7.37	1	12.50	25.00	25.00	7.37
90150	LIMITED EXAMINATION	2	25.00	40.00	80.00	23.59	2	25.00	40.00	80.00	23.59
90160	INTERMEDIATE EXAMINATION	1	12.50	48.00	48.00	14.15	1	12.50	48.00	48.00	14.15
90170	EXTENDED RE-EXAM	3	37.50	43.33	130.00	38.34	3	37.50	43.33	130.00	38.34
TOTAL		8	100.00	42.37	339.00	100.00	8	100.00	42.37	339.00	100.00
HOSPITAL VISITS											
90200	INITIAL HOSPITAL CARE	2	20.00	31.00	62.00	10.82	2	20.00	31.00	62.00	10.82
90215	INITIAL CARE - INTERMEDIATE	2	20.00	65.00	130.00	22.68	2	20.00	65.00	130.00	22.68
90220	INITIAL CARE - COMPREHENSIVE	1	10.00	245.00	245.00	42.75	1	10.00	245.00	245.00	42.75
90240	BRIEF EXAMINATION	1	10.00	12.00	12.00	2.09	1	10.00	12.00	12.00	2.09
90250	LIMITED EXAMINATION	2	20.00	25.00	50.00	8.72	2	20.00	25.00	50.00	8.72
90260	INTERMEDIATE EXAMINATION	2	20.00	37.00	74.00	12.91	2	20.00	37.00	74.00	12.91
TOTAL		10	100.00	57.30	573.00	100.00	10	100.00	57.30	573.00	100.00
PAYMENTS											
1	PAYMENT	7	70.00	22.85	160.00	16.35	7	70.00	22.85	160.00	16.35
2	PAYMENT BY CHECK	2	20.00	34.00	68.00	6.95	2	20.00	34.00	68.00	6.95
3	INSURANCE PPAYMENT	1	10.00	750.00	750.00	76.68	1	10.00	750.00	750.00	76.68
TOTAL		10	100.00	97.80	978.00	100.00	10	100.00	97.80	978.00	100.00

Figure 11. ANALYSIS OF SERVICES
This report is sorted by type of service rendered and by payment type. It shows the number, percent of total, average amount and total amount for each service rendered this month and year-to-date. This report is basically a sales analysis of the practice showing where the money is coming from.

The Use of Microcomputers for Business Risk Analysis

By Jon R. Prescott

In many businesses today, and particularly small ones, problems are frequently encountered or become quite complex in attempting to use computer simulation techniques. First, there is the issue of credibility, and secondly, in the past, simulation tools have tended to be expensive, especially for smaller firms. Many of these companies simply cannot afford a full-time (or perhaps even part-time) specialist/expert in the simulation of engineering or manufacturing problems. Another source of significant expense to these companies is, or at least has been the substantial use of expensive processing time of a large computer system, such as an IBM 360/370, a CDC 6600, or UNIVAC 1108.

A very exciting and fairly recent advance in the state of the art in computer technology, the microcomputer, is now available for business problem solving. The microcomputer has virtually become the center of a major revolution in the computer industry both here and abroad. In computer simulation, which is the subject of this article, the necessary computer program is written in BASIC, requires approximately 5K bytes of memory, and is run on a microprocessor (IMSAI 8080) with floppy disc. The running time for a program with 5,000 simulations (a random number generator or computer routine which is utilized by another program 5,000 times) is nearly 35 minutes, and costs about $22-25. To critics of computer risk models who typically refer to costly computer time, I advocate serious consideration of the use of a microcomputer system, such as the one described here.

The following is a case in point of solving a specific problem utilizing this approach. A company management wants to predict its risk related to a proposed product line diversification, hence certain factors must be weighed and data made available in its marketing strategy. Examples of such parameters include: the company's knowledge of the number of competitors, the contemplated level of investment, the desired return on this investment, the planned timing of the product introduction, and the expected response of the competitors. If it appears that the desired variable of business risk can be estimated with a certain level of confidence, can a computer program be written to implement such a methodology — and cost-effectively? Lastly, what would be the credibility and usefulness of such a program and its output to management?

In essence, we are interested in the application of a microcomputer and quantitative methods (i.e., Monte Carlo simulation) to analyze the business decision-making process in a company, under conditions of uncertainty. This information in this article is based on a consulting assignment performed by the author.

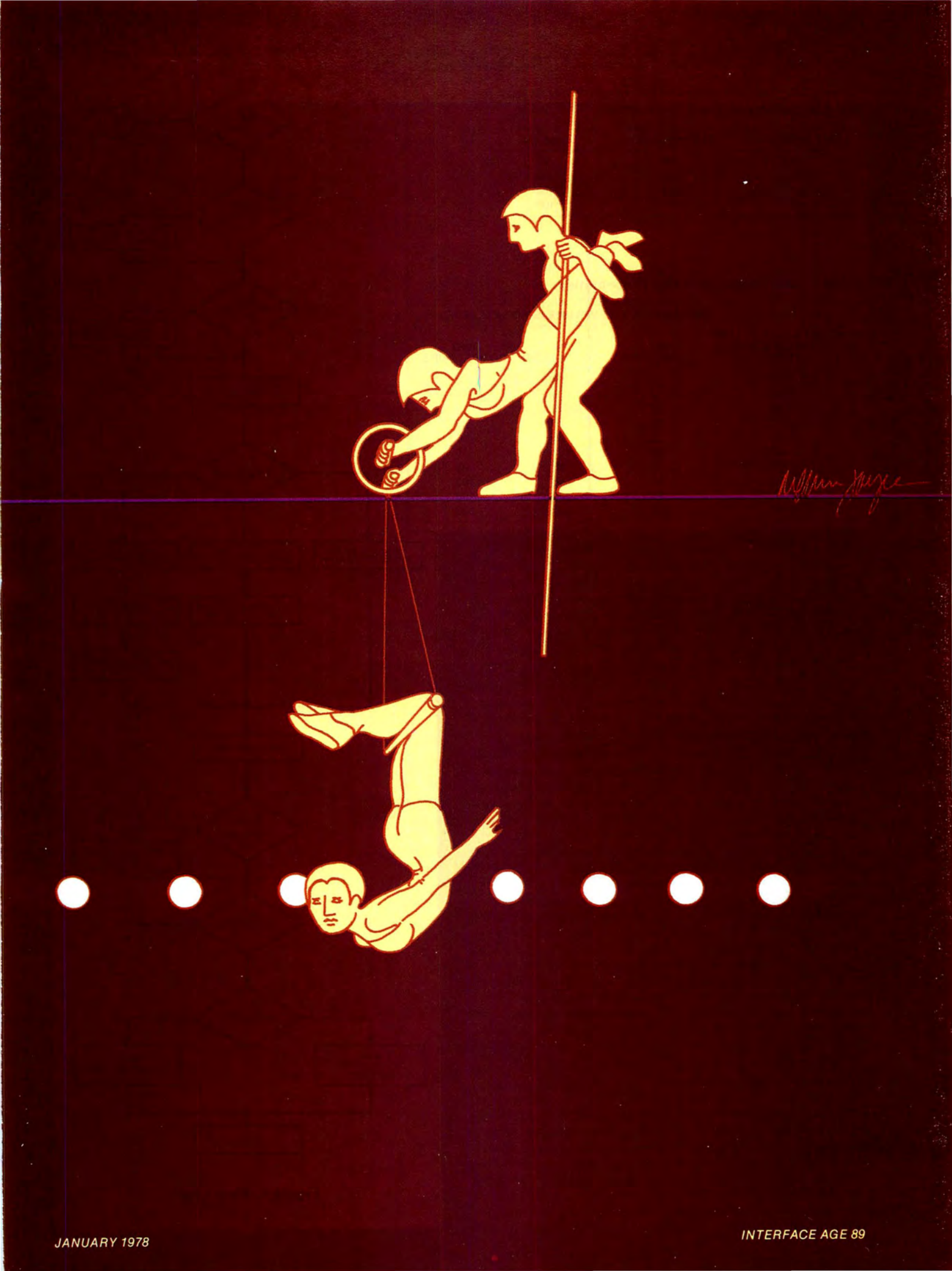

Table I. Probability distribution of time necessary for two competitors to enter the market.

TIME (MONTHS)	FLYBYNTE (%)	FAST (%)
6	50	20
12	75	60
18	100	80
24	100	100

Table II. Distribution of Sales Probabilities.

	PROBABILITY THAT VOLUME IS NOT EXCEEDED (%)		
MONTHLY SALES VOLUME LESS THAN OR EQUAL TO (UNITS)	NO COMPETITOR	ONE COMPETITOR	TWO COMPETITORS
1,000	0	0	0
2,000	0	4	7
3,000	5	11	15
4,000	13	20	40
5,000	25	35	60
6,000	50	62	85
7,000	70	85	95
8,000	85	95	100
9,000	95	100	100
10,000	100	100	100

the executive vice-president of marketing and sales. Concerning Variable II, an alternate source of data, for comparative purposes, was the cumulative frequency distribution of the company's monthly sales levels for a given year. Worthy of mention also was that the individual data point or datum tended to be their perceptions of what would be of real use to the company user(s), such as themselves.

Tables I and II contain the actual data referenced above. Figure 1, the flow chart, displays the structure or the algorithm in this Monte Carlo approach to business risk analysis.

Running the model based on the above data yielded a predicted risk of about 0.65, or a NO GO decision on the product diversification option before management (see the flow chart on this point). Analyses conducted on the variables and data seemed consistently to portray the variable, predicted risk, as rather sensitive, i.e., it decreases for moderate increases in Variable II, but generally marginal or insignificant increases for medium variation in Variable I. This finding appeared to be particularly true in the case of larger investment levels, say, $20,000 and more. This level happened to be the one of definite interest to the company. Not surprisingly, the estimated risk would increase with time until the product is unveiled. For example, experimentation here reflected that after some increase in the time period, the estimated risk gradually decreased. One might interpret this finding as a measure of improved planning within the company, of the new product development, financing, and product evaluation.

Though not all model development here is complete, the results to date have tended to imply that the new product innovations are, in a general sense, a somewhat risky undertaking which some may contend is an understatement of the problem. In fact, both experts in marketing and business marketing texts usually support this view. Also, discussion of this computer simulation model and its results with a staff member of the nearby SRI International has revealed that very similar research and findings had been reported there as well. Further, an

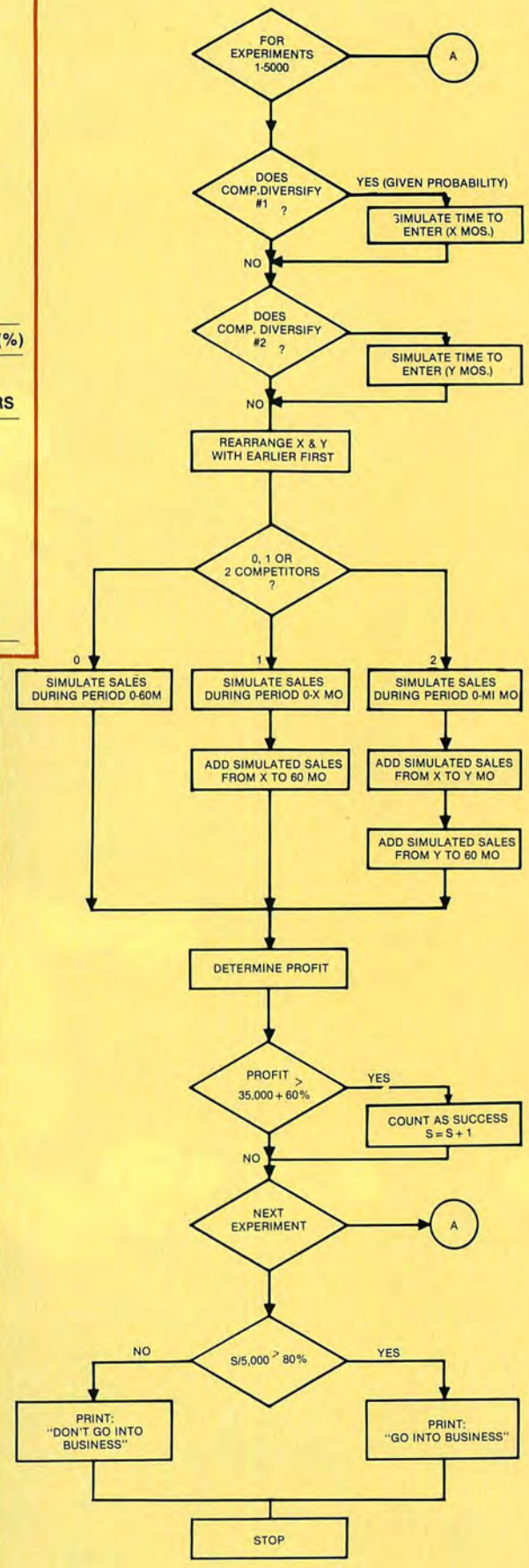

Figure 1. Flow Chart

agricultural feed corporation had chosen to pursue such an analysis on an IBM 370/168 using FORTRAN IV code.

In conclusion, it is believed that this microcomputer-based business model does allow for a better understanding, from a scientific perspective, of the complexities of decision-making in product marketing problems. As of this writing, current software development has increased the number of competitors to 10, and the variable of market share is being considered as a possible addition to the current structure of the model.

With the ever-decreasing cost of mini and microcomputer hardware, and more applicable software which is available, the small business that does not decide to employ such a tool for modern planning could find itself at a distinct disadvantage. One other relevant point about some of the more recently available software published in books is the emphasis on proper interpretation of the computer program printout.

REFERENCES

1. **Knuth, D.E., The Art of Computer Programming.** *II. Seminumerical Algorithms.* Addison-Wesley, Reading, MA 1972.
2. INTEL Corporation, *INTEL 8080 Microcomputer System Manual,* January 1075.


```
OK
LIST
10 T$="MS.02  MONTE CARLO SIMULATION OF BUSINESS
           DECISION"
12 V$="06/05/77"
20 REM =
40 C$=":":Z$="00"
42 Z0=96
50 DIM A(4,2),W(4,2)
55 T1=4: T2=4: D1=10
58 J=LEN(T$)+5
60 DIM S(10,2)
62 PRINT:PRINT:PRINT T$;TAB(J);V$
68 PRINT:PRINT FRE(1);" BYTES FREE STORAGE"
70 U=1: REM = RANDOM GENERATOR SEED
73 PRINT
74 R=0
75 GOSUB 8350: GOSUB 8340: REM = START TIME
78 INPUT"WANT DISTRIBUTION TABLES";T$
79 T$=LEFT$(T$,1)
80 H1=HS:H2=M1:H3=SE
82 IF T$<>"Y" THEN 90
85 PRINT:PRINT"A'S ENTRY-TIME DISTRIBUTION"
90 FOR I=1 TO T1: X=5
100 FOR J=1 TO 2
101 READ A(I,J):IF T$<>"Y" THEN 103
102 PRINTTAB(X);A(I,J);
103 X=X+10:NEXT J:IF T$="Y" THEN PRINT
104 NEXT I:PRINT
105 IF T$<>"Y" THEN 108
106 PRINT
107 PRINT "B'S ENTRY-TIME DISTRIBUTION"
108 FOR I=1 TO T2: X=5
110 FOR J=1 TO 2
111 READ W(I,J):IF T$<>"Y" THEN 113
112 PRINTTAB(X);W(I,J);
113 X=X+10:NEXT J:IF T$="Y" THEN PRINT
114 NEXT I:PRINT
115 IF T$<>"Y" THEN 118
116 PRINT
117 PRINT "SALES DISTRIBUTION"
118 FOR I=1 TO D1: X=5
120 FOR J=0 TO 2
121 READ S(I,J):IF T$<>"Y" THEN 123
122 PRINTTAB(X);S(I,J);
123 X=X+10:NEXT J:IF T$="Y" THEN PRINT
124 NEXT I:PRINT
125 GOSUB 8500: REM = LAPSE TIME
130 PRINT
150 Y=0
160 P1=.50
170 P2=.30
180 K3=1000
200 A=RND(0)
220 INPUT "HOW MANY SIMULATIONS";N9
230 N8=INT(N9/5): REM = O/P FREQ
240 INPUT "HOW MANY YEARS";YR
250 M0=YR*12
260 INPUT "EXPECTATION OF PROFIT (0<E<1)";E
265 INPUT "MAXIMUM RISK (0=NONE, 1=CAN'T WIN)";RISK
270 INPUT "INITIAL INVESTMENT";V0
275 INPUT "PRODUCTION QTY FOR RATE-BREAK";V
280 PRINT"PROFIT PER UNIT BELOW"V"UNITS";:INPUT A1
285 PRINT"PROFIT PER UNIT ABOVE"V"UNITS";:INPUT A2
288 PRINT
290 K8=1
295 GOSUB 8500: REM = LAPSE TIME
299 REM          BEGIN SIMULATION LOOP
300 FOR I=1 TO N9
320 IF K8<N8 THEN 350
330 PRINT I;" SIMULATIONS"
340 K8=0
350 K8=K8+1
400 C=0
410 M1=M0
420 M2=M0
500 A=RND(0)
600 W=RND(0)
700 IF A>P1 THEN 1400
701 REM.  HOW LONG DOES A      TAKE
702 REM.  TO GET INTO THE MARKET?
800 C=C+1
900 A=RND(0)
1000 FOR J=1 TO 3
1100 IF A<A(J,2) THEN 1300
1200 NEXT J
1300 M1=A(J,1)
1400 IF W>P2 THEN 2010
1401 REM.  HOW LONG DOES B      TAKE
1402 REM   TO GET INTO MARKET?
1500 C=C+1
1600 A=RND(0)
1700 FOR J=1 TO T2
1800 IF A<W(J,2) THEN 2000
1900 NEXT J
2000 M2=W(J,1)
2009 REM.  LOWEST IN M1, HIGHEST IN M2
2010 IF M1<M2 THEN 2100
2020 A=M1
2030 M1=M2
2040 M2=A
2100 IF C=0 THEN 2400
2200 IF C=1 THEN 3000
2300 IF C=2 THEN 4100
2398 REM.  MONTHLY SALES
2399 REM   WHEN NO COMPETITORS
2400 S1=RND(0)
2500 FOR J=1 TO D1
2600 IF S1<S(J,0) THEN 2800
2700 NEXT J
2800 S=(J-1)*K3*M0
2900 GOTO 5600
2998 REM.  MONTHLY SALES WHEN
2999 REM   ZERO & ONE COMPETITOR
3000 S1=RND(0)
3100 FOR J=1 TO D1
3200 IF S1<S(J,0) THEN 3400
3300 NEXT J
3400 S=(J-1)*K3*M1
3500 S1=RND(0)
3600 FOR J=1 TO D1
3700 IF S1<S(J,1) THEN 3900
3800 NEXT J
3900 S=S+(J-1)*K3*(M0-M1)
4000 GOTO 5600
4097 REM.  MONTHLY SALES WHEN
4098 REM   ZERO, ONE & TWO COMPETITORS
4100 S1=RND(0)
4200 FOR J=1 TO D1
4300 IF S1<S(J,0) THEN 4500
4400 NEXT J
4500 S=(J-1)*K3*M1
4600 S1=RND(0)
4700 FOR J=1 TO D1
4800 IF S1<S(J,1) THEN 5000
4900 NEXT J
5000 S=S+(J-1)*K3*(M2-M1)
5100 S1=RND(0)
5200 FOR J=1 TO D1
5300 IF S1<S(J,2) THEN 5500
5400 NEXT J
5500 S=S+(J-1)*K3*(M0-M2)
5599 REM.  DETERMINE PROFIT
5600 IF S>V THEN 5900
5700 P=A1*S
5800 GOTO 6000
5900 P=A1*V+A2*(S-V)
5999 REM.  SUCCESSFUL SCENARIO?
6000 IF P<V0*(1+E) THEN 6200
6100 Y=Y+1: REM = SUCCESS
6200 NEXT I
6210 REM          END OF SIMULATION LOOP
6220 PRINT
6250 Q=Y/N9
6340 PRINT"THE PROBABILITY OF ACHIEVING "E*100"% PROFIT"
```

```
6400 PRINT"IN "YR" YEARS IS";U
6500 IF U>RISK THEN 6600
6600 PRINT "DON'T GO INTO THE BUSINESS"
6700 GOTO 6900
6800 PRINT "GO AHEAD INTO THE BUSINESS"
6900 HS=HI:MI=H2:SE=H3
6910 GOSUB 8500
6990 STOP
6998 REM
6999 REM.  A's      ENTRY TIME DISTRIBUTION
7000 DATA  6, .50
7001 DATA 12, .75
7002 DATA 18,1.00
7003 DATA 24,1.00
7010 REM.  B's            ENTRY TIME DISTRIBUTION
7011 DATA  6, .20
7012 DATA 12, .60
7013 DATA 18, .80
7014 DATA 24,1.00
7020 REM.  SALES DISTRIBUTION
7021 DATA    0,   0,   0
7022 DATA    0, .04, .07
7023 DATA  .05, .11, .15
7024 DATA  .13, .20, .40
7025 DATA  .25, .35, .60
7026 DATA  .50, .62, .85
7027 DATA  .70, .85, .95
7028 DATA  .85, .95,1.00
7029 DATA  .95,1.00,1.00
7030 DATA 1.00,1.00,1.00
8340 REM            PRINT CLOCK TIME
8341 T=HS: GOSUB 8400: H$=T$
8342 T=MI: GOSUB 8400: M$=T$
8343 T=SE: GOSUB 8400: S$=T$
8345 PRINT H$+C$+M$+C$+S$
8348 RETURN
8350 REM            GET CLOCK TIME
8352 T=12+R: REM = 1-SECOND
8354 GOSUB 8390
8356 SE=T: SI=T
8358 T=13+R: REM = 10-SECONDS
8360 GOSUB 8390
8362 SE=SE+10*T
8364 T=14+R: REM = 1-MINUTE
8366 GOSUB 8390
8368 MI=T: T=10+R: REM = 10-MINUTES
8370 GOSUB 8390
8372 MI=MI+10*T: T=9+R: REM= 1-HOUR
8374 GOSUB 8390
8376 HS=T: T=8+R: REM = 10-HOURS
8378 GOSUB 8390
8380 HS=HS+10*T: IF R>0 THEN RETURN
8382 T=12: GOSUB 8390
8384 IF SI>T THEN 8350
8386 OUT 20,R
8388 RETURN
8390 REM      INTERROGATE TIME CARD <CLOCK>
8392 OUT 20,T
8394 T=INP(20)-240
8396 IF T=15 THEN T=T-T
8398 RETURN
8400 REM            FORMAT CLOCK TIME
8410 T$=STR$(T)
8420 T=LEN(T$)-1
8430 T$=RIGHT$(T$,T): REM = GET RID OF LEADING BLANK
8440 T$=Z$+T$: REM = ADD LEADING ZERO
8450 T$=RIGHT$(T$,2): REM = KEEP LAST 2-DIGITS
8460 RETURN
8500 REM            LAPSE TIME
8501 IF HS+MI+SE<>0 THEN 8510
8502 HH=0:MM=0:SS=0
8504 GOTO 8590
8510 HL=HS:ML=MI:SL=SE
8515 GOSUB 8350: REM = READ THE CLOCK
8518 GOSUB 8340: REM = PRINT TIME
8520 HH=HS-HL
8522 MM=MI-ML
8524 SS=SE-SL
8530 IF SS=>0 THEN 8540
8535 SS=SS+60: MM=MM-1
8540 IF MM=>0 THEN 8550
8545 MM=MM+60: HH=HH-1
8550 IF HH<0 THEN HH=HH+12
8560 PRINTTAB(10);
8590 PRINT HH":"MM":"SS"  LAPSE TIME"
8595 RETURN
9999 END
OK
```


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CIRCLE INQUIRY NO. 55

By Richard E. Michels

INTRODUCTION

From time to time, many of us have probably considered buying a piece of income property, because of the well-known tax savings potential, as well as employing that method to build an estate for ourselves, as well as for future generations. Many of us have hesitated to "jump in" not knowing how to analyze the property to tell whether or not we are getting a fair deal.

The advent of the microcomputer has made it possible to automate many of the complex sounding calculations involved in the purchase of an apartment building. When such a program is put together with an explanation of some of the terminology, personal ownership of such a property can become a reality. Although a computer program cannot actually make the decision, it can vastly simplify the decision-making process.

Following a discussion of the terminology and a description of the BASIC program, an example is given of an actual analysis of an apartment building.

BASIC program listings are provided for the SWTPC 6800 and a 6502 FOCAL based system. A timing comparison was also performed.

TERMINOLOGY

When negotiating on a building there can be a lot of emotion and "heat" involved, leaving open the possibility of making a last minute mistake leading to disaster. Imagine yourself sitting in your living room with a broker who is presenting a counter-offer on a building you think you want very much. The counter-offer is due to expire shortly. You have offered the seller a second mortgage at 9% interest, and the broker says: "The seller wants 10½% over 20 years and I can show you where this will bring you 10% cash flow. This is the seller's last offer and you have to decide tonight whether you want the building or not." The broker proceeds to whip out his handy *Money Manager* calculator and demonstrates the truth of his statement. Un-noticed by either you (or your wife) he calculates a 30-year amortization by mistake, rather than 20 years. You may end up signing on the dotted line and living with negative rather than positive cash flow for years. However, with this program, you could have out drawn the broker.

Apartment houses are one form of income-producing property. Of the several approaches used to determine fair market value of a building, the income approach is probably used most extensively.

This article describes the income approach to appraising a property, and lays out a program written in BASIC, which will perform all the calculations necessary to produce the income components.

There are six forms of income associated with apartment houses. They are:

SGI — Scheduled Gross Income
GOI — Gross Operating Income
NOI — Net Operating Income
EI — Equity Income
CF — Cash Flow (and Spendable Income)
TI — Taxable Income

SCHEDULED GROSS INCOME is the maximum available cash which can be produced from the property, assuming 100% occupancy. It includes all rents from the rental units, laundry, parking, vending machines, and any other miscellaneous sources of income, such as air conditioner rentals, etc.

GROSS OPERATING INCOME represents the amount of cash actually collected by the owner or his agents. It is the amount of money available to pay all expenses, including utilities, mortgages, replacement items, etc. The GOI is the Scheduled Gross Income discounted for a vacancy factor. The vacancy factor includes income lost due to vacant units, and therefore less income from laundry, parking, etc. The relationship between SGI, GOI, and vacancy can be expressed as:

$$GOI = (1 - VAC) \times SGI$$

where VAC is the vacancy factor expressed as a decimal percent.

The NOI, or NET OPERATING INCOME, represents the amount of cash left after paying for expenses, such as utilities, advertising and management. There are basically two types of expenses — capitalized and non-capitalized expenses. Non-capitalized expenses are those costs which are fully deductible at tax time. Capitalized expenses are those items which must be depreciated or amortized over a period of time longer than one year, such as a new boiler, cost of the building itself, or an attorney's fee resulting from the purchase of the building.

Expenses written off against the Gross Operating Income to produce the NOI represent the non-capitalized expenses. It is not necessary to know each non-capitalized expense item to analyze an apartment building. Like the vacancy factor, an expense factor may be employed in the analysis. The expense factor is a function of age of the building, size, type of construction, area of the country in which the building is located, and quality of the management. Ball park figures may be obtained from the local Apartment Owners Association, Commercial Real Estate Brokers, or a publication entitled *Income/Expense Analysis; Apartments, Condominiums, and Cooperatives* available from Institute of Real Estate Management, 430 North Michigan Avenue, Chicago, Illinois 60611. The important thing is that the expense factor be treated as a variable or parameter, so that the "sensitivity" of the income stream may be quickly examined to see the effects of changes in expense factor of a few percentage points one way or the other. If E is the expense factor, then

$$NOI = (1\text{-}E) \times GOI$$
$$NOI = (1\text{-}E) \times (1\text{-}VAC) \times SGI$$

CF, CASH FLOW, or Spendable Income is the amount of "in pocket" cash left after paying for any mortgages or financing costs. Payments for financing represent money which must come out of the NOI. If financing costs are represented by M, then

$$CF\ (\$) = NOI\ (\$) - M\ (\$)$$
$$= (1\text{-}E)\ (\%) \times (1\text{-}VAC) \times SGI\ (\$) - M\ (\$)$$

Cash Flow is important, since it represents the amount of money left over for beer at the end of the month.

EQUITY INCOME, or EI, is cash flow plus accrued principal payments against property financing. It represents


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the amount of mortgage reduction on the property plus cash income, and can be presumably fully retrieved at some future time of sale. All other factors being equal, the amount of equity will increase over time by virtue of these principal payments. Therefore,

$$EI\ (\$) = NOI\ (\$) + P\ (\$)$$

where P ($) is the total amount of principal paid.

TI or TAXABLE INCOME represents what Uncle Sam will apply his own weighting factor to in April. Depending on our individual objectives, most of us would like to see TI be a negative number, so that "negative income" may be written off against other sources of cash to minimize our tax bite. Taxable Income is cash flow discounted for all depreciated expenses, such as depreciation against the building itself, three-year depreciation against a new water heater, etc. If D ($) is the depreciation, then

$$TI\ (\$) = EI\ (\$) - D\ (\$) \text{ (hopefully negative)}$$
$$= (1\text{-}E)\ (\%) \times (1\text{-}VAC)\ (\%) \times SGI\ (\$) + P\ (\$) - D\ (\$)$$

One other expense item should be mentioned: the "Sinking Fund." Sinking fund dollars represent money set aside, like in a separate account, for future replacement expenses, such as inventory items (sofa, lighting fixtures, carpet) or a new boiler, etc. Although these items may be costly, these expenditures are to some extent dependent on management philosophy and are therefore not normaly in the analysis; i.e., the broker's sheets describing the property for sale do not normally contain this item.

In order to tie all of the above together, let's examine a sample apartment property. The following is a description of the Turkey Apartments located at 1469 Podunk. Information represents data provided us on the "Broker's Sheet" or Income Statement:

INCOME AND EXPENSES

Name of Property: Turkey Apartments
Address: 1469 Podunk
Size of Building: 14,000 Sq. Ft. Zoning: R-4
Number of Units: 27 Age: 1950

ASSESSED VALUATION

Land 26% Improvements 70% Personal 4%

LOAN INFORMATION

Encumbrances $ Clear Rate % Payable Due
$ Rate % Payable Due

INCOME DETAIL

Unit	Type	Rent	Unit	Type	Rent	Unit	Type	Rent
101	1-Bdrm	$135	201	1-Bdrm	$135	301	1-Bdrm	$135
102	2-Bdrm	145	202	2-Bdrm	135	302	2-Bdrm	130
103	1-Bdrm	145	203	1-Bdrm	135	303	1-Bdrm	135
104	1-Bdrm	120	204	1-Bdrm	110	304	1-Bdrm	135
105	Buffet	120	205	Buffet	90	305	Buffet	90
106	1-Bdrm	135	206	1-Bdrm	130	306	1-Bdrm	135
107	1-Bdrm	125	207	1-Bdrm	135	307	1-Bdrm	135
108	2-Bdrm-Mgr	150	208	2-Bdrm	155	308	2-Bdrm	135
			209	1-Bdrm	130	309	1-Bdrm	135
			Laundry Income		50	B-1	1-Bdrm	125

Gross Monthly Income $3,570.00
Gross Annual Income $42,840.00
Est. Vacancy 3% $ 1,285.00
Adjusted Annual Income $41,555.00

OPERATING EXPENSES (ANNUAL)

Real Estate Taxes, 1977	$ 5,426.60
Personal Property Tax, 1977	$ 233.38
Hazard Insurance	$ 925.00
Gas $3,719 Electricity $540	$ 4,259.00
Water and Sewer	$ 2,075.00
Resident Manager $150 Apt.	$ 1,980.00
Maintenance, Repair and Supplies Estimate 7% of Adj. Ann. Inc.	$ 2,908.85
Trash Removal	$ 240.00
Advertising	$ 86.00
Annual Total Expenses	$18,133.83
Net Income Before Debt Service	$23,421.17

PRICE $295,000

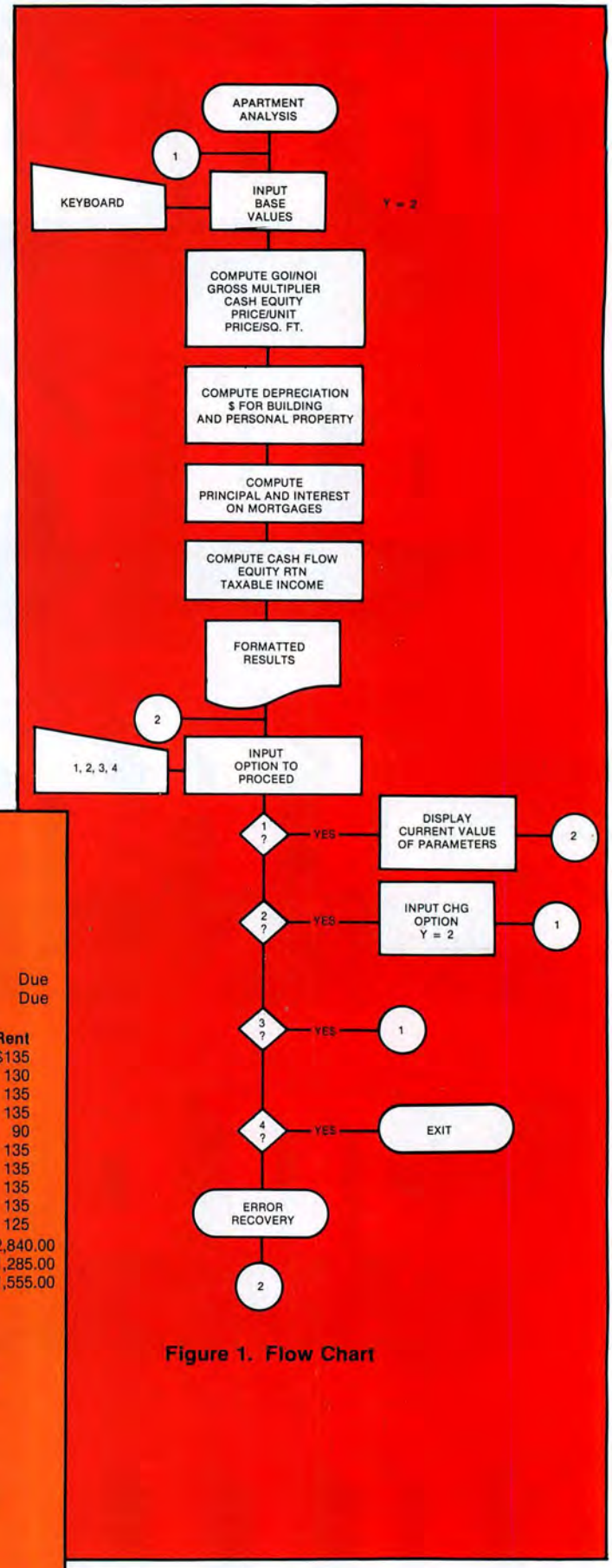


Figure 1. Flow Chart

Note that the Gross Annual Income is $42,840, which is what we're calling the SGI, and includes $50/month or $600 per year for laundry. The vacancy allowance is 3% resulting in a Gross Operating Income of $41,555 (GOI). Furthermore, the building shows $18,133.83 of annual non-capitalized or operating expenses. This represents an expense ratio of $18,133.83/$41,555 = 43.64%, resulting in a Net Operating Income (NOI), or Net In-

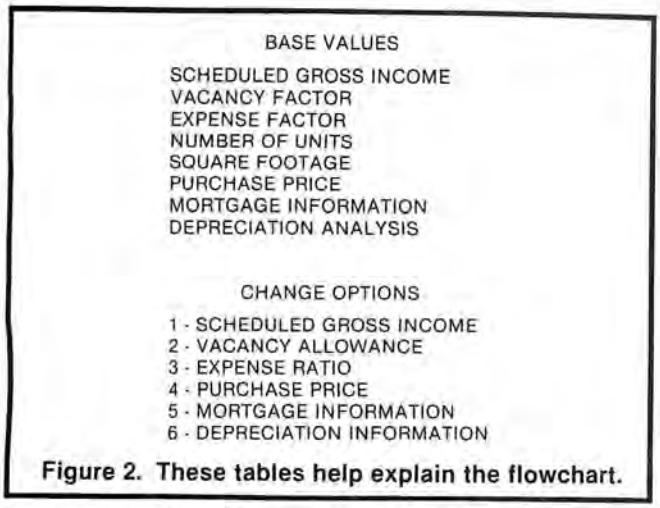


Figure 2. These tables help explain the flowchart.

come Before Debt Service of $23,421.17.

The effects of debt service are not shown, since the building is free of encumbrances and probably requires new financing. The asking price is $295,000 — how do we know whether or not this is a good deal? How much cash flow will this building produce? What happens if there is a recession resulting in a 10% vacancy rate, and expenses actually run closer to 48% than 44%? How much financing can this building support and yet produce an income equal to 10% of our cash downpayment?

To find the answers to these questions, and many more, we found it highly useful to write this BASIC program.

PROGRAM DESCRIPTION

The program is designed and is being used to provide a fast analysis of the parameters which define the price of an apartment building.

It will run in 5700 bytes of user RAM on the SWTPC 6800. If the user is running 8K BASIC, the program will then require 14K of RAM to execute. For run time comparison purposes, the program was also written to run under FOCAL software utilizing the 6502 chip. In this case, the computational code required 3K of user RAM without the front end comments.

For the 6800 system, DIGITS = 2 in statement 5 allows for two digits to the right of the decimal point in subsequent output. LINE = 0 in statement 6 allows the user to override the 64-column constraint peculiar to the SWTPC system. The somewhat unusual format specification (Line 1620 for example) was the method employed to make sure that the output numbers would print out right justified in the final results.

For evaluation purposes, we were particularly interested in comparing the execution time for the two systems. Based on previous discussion we expected the 6502 chip to win out. To perform the test, notice that statement 1140 of the SWTPC program is concerned with integer exponentiation. For the case of working with a balloon note, 1 + Q (I) is raised to the 1000 power, and it was expected that both systems would think about that one for a while. What we didn't expect was for the 6800 system to respond roughly twice as fast as the FOCAL. The 6800 required about 5 seconds to begin printout, whereas FOCAL on the 6502 required about 10 seconds. Our version of FOCAL dates to about November 1976, and it is expected that more recent versions would have executed faster. However, this isolated timing experience pointed out, once again that performance depends not only on chip speed, nor clock cycle time, but also on the associated supporting software and the user program involved. We intend to perform other additional timing studies for our applications, so as not to become mesmerized by "cycle times."

The BASIC program is interactive and will provide as many analyses as desired until you are finished. It provides a "First Year-On Purchase" analysis, which is to say it will give your position in the building assuming you bought effective January 1 and held the property through December 31st. It is more accurate than the broker's statement since the exact principal paid on the mortgages is computed. Normally, the broker will multiply the monthly interest rate times the mortgage amount the first month of ownership and then multiply the result times 12 to obtain the total interest paid. This is obviously incorrect, since the principal balance declines month by month. In the BASIC program, the exact calculation is made. The program can handle two types of mortgages; straight amortization or the "balloon" case. In the case of a balloon type mortgage, payments are usually interest only, over some period of time, and then a final "balloon" payment is made, usually some years downstream. A straight amortization payment is like a house payment, where principal and interest amounts are paid each month. To help minimize the degree of conversation with the user, an interest-only mortgage is handled subject to the same algorithms as straight amortization, except that the number of months representing the term of the loan is set to 1,000 or 83.3 years. In this way, the amount of principal contribution each month is so small as to introduce negligible error into the computations, while eliminating an additional I/O step.

Various depreciation options are available for the building as well as Personal Property. In those cases where a more complete depreciation analysis is desired, the reader is referred to the excellent article entitled "Depreciation Schedule Analysis Program — JHDSAP," by Jim Huffman in the September issue of INTERFACE AGE. This program treats all items as having $0 salvage value; that amount can be added to the price allocated to the land, since land cannot be depreciated, assuming it is purchased as part of the building.

The following quantities must be available to the program on input:

ITEM #	QUANTITY	UNITS	PGM	VARIABLE NAME
1	Scheduled Gross Income	$		G1
2	Expense Ratio	%		E1
3	Vacancy Factor	%		V1
4	Number of Apartments	N		N1
5	Square Feet in Building	N		F1
6	Price	$		P1
7	Mortgage Information; Amount, Yearly Interest Rate, Term	$,%,N		
8	Price Allocated to Building	%		A1
9	Price Allocated to Personal Property	%		A2
10	Depreciation Method (Bldg)	ALPHA		DS
11	Depreciation Method (Personal Property)	ALPHA		HS
12	Depreciation Period (Bldg)	YEARS (N)		Y1
13	Depreciation Period (Personal Property)	YEARS (N)		Y2

Once the above information has been inputted, the program performs the first analysis and then provides the following options:

1. Display Current Values
2. Change a value
3. Re-run the program
4. Done.

Execution of the program is relatively straightforward, whose flowchart is shown in Figure 1. Program listing is given in Figure 2, and Figure 3 gives a demonstration employing each of the input options. Note that when a value is changed, the changes are cumulative. That is, the last change to, say, the expense ratio, will be applied against the last change to the vacancy factor.

Formatting was designed around a 24x64 character display. Width of the display can easily be shortened by reducing the number of displayed mortgages from four to three. No subroutines are employed and no implicit or

explicit functions are used. The maximum dimensioned array is five.

ADDITIONAL CALCULATIONS

Besides the aforementioned income stream measure, note that the program also calculates Cap Rate, Price per Square Foot, Price per Unit, and Gross Multiplier. These quantities are additional check points on the price of a building. By comparing these numbers against similar quantities for other buildings, a relative standing for your "buy" may be obtained.

The meaning of price per square foot and price per unit are obvious, whereas capitalization requires a little explanation. Cap rate is defined mathematically as follows:

$$\text{Cap Rate (\%)} = \text{NOI/Price}$$

In order for an apartment building to produce a given return on cash invested, it must yield a given "capitalization" rate. Since this is tied in with cash invested, or cash downpayment, the cap rate a building is required to produce is a function of vacancy, non-capitalized expenses and financing terms. A building with a higher cap rate will produce better income, but the degree of income required depends on the individual requirements. Here again, beginning guidelines can be obtained from the aforementioned sources.

TRIAL RUN

Now that the buzz words and program are understood, let's employ them to help analyze the Turkey Apartments. The broker tells us that "the building is owned free and clear, and new financing will be required to consummate the sale. Banks are loaning 70% of the contract price over 25 years at 10% interest on a building of this age." Our CPA tells us that we can probably depreciate the building over 20 years using the Straight Line method, with Personal Property taken on a Double Declining Balance over five years. The vacancy rate is 3% and a calculation of the expenses shows that it runs 43.6%. After inputting these data into the program, we find the building will produce 1% cash flow, 3.2% equity return, with a first year tax shelter of -$7,466.64. Although the tax shelter is appealing, there is not enough cash flow to suit our purposes, so see what happens if the price is dropped to $260,000, and maybe, just maybe, we can talk the seller into giving us a second mortgage of $39,000, interest only, and finance a first of only $143,000 @ 10% over 25 years. As we can see, the cash flow increases to 6%, equity return goes to 7.8%, but the tax shelter falls to -$3,038.71. On further examination, we find the building has been poorly run, with high utility and maintenance costs. We feel the actual expenses will run closer to 38% than 43.64%. Putting in this new figure for expenses results in an increase in cash flow to 9.0% and first year equity return of 10.8%. However, this increase in cash flow has been at the expense of decreasing the tax shelter benefits. Nevertheless, finding that this represents a good compromise for our purposes, we present our offer to the seller. Although the seller is not particularly fond of financing a second mortgage, he agrees to allow us to use his building to begin our personal fortune (and hence finance that additional 16K RAM we didn't get last Christmas!)

Figure 3. Sample Run

```
RUN
DO YOU NEED HELP WITH THIS PROGRAM ('Y'=YES,'N'=NO)
? Y
THIS PROGRAM COMPUTES THE COMPONENTS OF PROFIT
RELATED TO THE PURCHASE OF AN APARTMENT BUILDING.
THE COMPONENTS OF PROFIT ARE GOI-GROSS OPERATING
INCOME, NOI-NET OPERATING INCOME, CASH FLOW OR
SPENDABLE INCOME, EQUITY INCOME, AND TAXABLE INCOME.
IN ADDITION, CAP RATE IS COMPUTED, AS WELL AS PRICE
PER SQ FT.  PARAMETERS, SUCH AS MORTGAGE INTEREST
RATES CAN BE VARIED TO SEE THEIR EFFECT ON THE
PROFIT COMPONENTS.
WHAT IS THE YEARLY SCHEDULED GROSS INCOME?
? 42840
WHAT IS THE VACANCY ALLOWANCE IN PERCENT?
? 3
WHAT IS THE EXPENSE RATIO (%) RELATIVE TO THE GOI?
? 43.64
HOW MANY UNITS DOES THIS BUILDING HAVE?
? 27
HOW MANY SQUARE FEET DOES THIS BUILDING HAVE?
? 14000
WHAT IS THE PROPOSED PURCHASE PRICE?
? 295000
HOW MANY MORTGAGES WILL THERE BE AGAINST THE PROPERTY?
? 1
FOR BALLOON OR INTEREST ONLY MORTGAGES SET MONTHS=10000
WHAT IS THE AMOUNT ($), TERM (MONTHS),
AND INTEREST RATE (%) OF MORTAGE NUMBER 1.00
? 206500,300,10
FOR DEPRECIATION PURPOSES WHAT IS THE PERCENTAGE
ALLOCATION TO THE BUILDING?
? 70
PERCENTAGE ALLOCATION TO PERSONAL PROPERTY?
? 4
WHAT IS THE DEPRECIATION METHOD TO BE USED ON THE BLDG
 ('DDB', 'SL', '125%')?
? SL
BUILDING DEPRECIATION PERIOD IN YEARS?
? 20
PERSONAL PROPERTY DEPR - ('DDB', 'SL' ,'125%', '150%')?
? DDB
PP PERIOD IN YEARS?
? 5

SCHEDULED GROSS          42840.00
VACANCY (3.00 %)          1285.20
        GOI              41554.80
EXPENSE RATIO (43.64 %)18134.51
        NOI              23420.28
                    FINANCING                    NOI  23420.28
MORTGAGE          1         2         3         4
INTEREST      20561.97      0.00      0.00      0.00
PRINCIPAL      1955.62      0.00      0.00      0.00
TOTAL         22517.60      0.00      0.00      0.00
                                CASH FLOW (1.01 %)    902.67
                                PRINCIPAL            1955.62
                                EQUITY RTN(3.22 %)   2858.30
                                DEPRECIATION        10325.00
                                TAXABLE             -7466.69
PURCHASE PRICE=295000.00 LOAN AMOUNT=206500.00 EQUITY=88500.00
CAP RATE BASED ON PRICE= 7.93 %   GROSS MULTIPLIER= 7.09
PRICE/UNIT= 10925.92      PRICE PER SQ FT= 21.07


DO YOU WISH TO 1-DISPLAY CURRENT VALUES, 2-CHG A VALUE ,
3-RERUN PROGRAM, 4-DONE
? 2

DO YOU WISH TO CHANGE:
1- SCHEDULED GROSS INCOME
2- VACANCY ALLOWANCE
3- EXPENSE RATIO
4- PURCHASE PRICE
5- MORTGAGE INFORMATION
6- DEPRECIATION INFORMATION
? 4
WHAT IS THE PROPOSED PURCHASE PRICE?
? 260000

SCHEDULED GROSS          42840.00
VACANCY (3.00 %)          1285.20
        GOI              41554.80
EXPENSE RATIO (43.64 %)18134.51
        NOI              23420.28
                    FINANCING                    NOI  23420.28
MORTGAGE          1         2         3         4
INTEREST      20561.97      0.00      0.00      0.00
PRINCIPAL      1955.62      0.00      0.00      0.00
TOTAL         22517.60      0.00      0.00      0.00
                                CASH FLOW (1.68 %)    902.67
                                PRINCIPAL            1955.62
                                EQUITY RTN(5.34 %)   2858.30
                                DEPRECIATION         9100.00
                                TAXABLE             -6241.69
PURCHASE PRICE=260000.00 LOAN AMOUNT=206500.00 EQUITY=53500.00
CAP RATE BASED ON PRICE= 9.00 %   GROSS MULTIPLIER= 6.25
PRICE/UNIT= 9629.62       PRICE PER SQ FT= 18.57


DO YOU WISH TO 1-DISPLAY CURRENT VALUES, 2-CHG A VALUE ,
3-RERUN PROGRAM, 4-DONE
? 2

DO YOU WISH TO CHANGE:
1- SCHEDULED GROSS INCOME
2- VACANCY ALLOWANCE
3- EXPENSE RATIO
4- PURCHASE PRICE
5- MORTGAGE INFORMATION
6- DEPRECIATION INFORMATION
? 5
HOW MANY MORTGAGES WILL THERE BE AGAINST THE PROPERTY?
? 2
FOR BALLOON OR INTEREST ONLY MORTGAGES SET MONTHS=10000
WHAT IS THE AMOUNT ($), TERM (MONTHS),
AND INTEREST RATE (%) OF MORTAGE NUMBER 1.00
? 143000,300,10
WHAT IS THE AMOUNT ($), TERM (MONTHS),
AND INTEREST RATE (%) OF MORTAGE NUMBER 2.00
? 39000,1000,8

SCHEDULED GROSS          42840.00
VACANCY (3.00 %)          1285.20
        GOI              41554.80
EXPENSE RATIO (43.64 %)18134.51
        NOI              23420.28
                    FINANCING                    NOI  23420.28
MORTGAGE          1         2         3         4
INTEREST      14239.04   3119.84      0.00      0.00
PRINCIPAL      1354.26      0.00      0.00      0.00
TOTAL         15593.30   3124.06      0.00      0.00
                                CASH FLOW (6.02 %)   4702.91
                                PRINCIPAL            1354.26
                                EQUITY RTN(7.76 %)   6057.17
                                DEPRECIATION         9100.00
                                TAXABLE             -3042.82
PURCHASE PRICE=260000.00 LOAN AMOUNT=182000.00 EQUITY=78000.00
CAP RATE BASED ON PRICE= 9.00 %   GROSS MULTIPLIER= 6.25
PRICE/UNIT= 9629.62       PRICE PER SQ FT= 18.57


DO YOU WISH TO 1-DISPLAY CURRENT VALUES, 2-CHG A VALUE ,
3-RERUN PROGRAM, 4-DONE
? 2
```

```
DO YOU WISH TO CHANGE:
1- SCHEDULED GROSS INCOME
2- VACANCY ALLOWANCE
3- EXPENSE RATIO
4- PURCHASE PRICE
5- MORTGAGE INFORMATION
6- DEPRECIATION INFORMATION
? 3
WHAT IS THE EXPENSE RATIO (%) RELATIVE TO THE GOI?
? 38

SCHEDULED GROSS         42840.00
VACANCY (3.00 %)         1285.20
        GOI             41554.80
EXPENSE RATIO (38.00 %)15790.82
        NOI             25763.97
                  FINANCING                    NOI  25763.97
MORTGAGE          1          2          3          4
INTEREST      14239.04    3119.34       0.00       0.00
PRINCIPAL      1354.26       0.00       0.00       0.00
TOTAL         15593.30    3124.06       0.00       0.00
                                  CASH FLOW (9.03 %)   7046.60
                                  PRINCIPAL            1354.26
                                  EQUITY RTN(10.77 %)  8400.86
                                  DEPRECIATION         9100.00
                                  TAXABLE              -699.13
PURCHASE PRICE=260000.00 LOAN AMOUNT=182000.00 EQUITY=78000.00
CAP RATE BASED ON PRICE= 9.90 %   GROSS MULTIPLIER= 6.25
PRICE/UNIT= 9629.62       PRICE PER SQ FT= 18.57

DO YOU WISH TO 1-DISPLAY CURRENT VALUES, 2-CHG A VALUE ,
3-RERUN PROGRAM, 4-DONE
? 1

BUILDING HAS 27.00  UNITS AND 14000.00  SQ FEET
BUILDING ALLOCATION= 70.00 %  PERSONAL PROPERTY= 4.00 %
BLDG TAKEN UNDER SL DEPRECIATION OVER 20.00 YEARS
PERSONAL PROPERTY TAKEN UNDER DDB DEPR OVER 5.00 YEARS
MORTGAGE 1.00 =143000.00 OVER  300.00  MOS AT 10.00 %
MORTGAGE 2.00 =39000.00 OVER  1000.00  MOS AT 8.00 %

DO YOU WISH TO 1-DISPLAY CURRENT VALUES, 2-CHG A VALUE ,
3-RERUN PROGRAM, 4-DONE
? 4
THANK YOU

READY
#
```

Figure 4. Program Listing

```
0005 DIGITS= 2
0006 LINE= 0
0010 REM
0020 DIM M(5),N(5),O(5)
0020 DIM G(5),R(5),T(5),U(5),V(5)
0040 REM C$=MASTER I-O CODE
0050 REM I=MASTER INDEX
0060 PRINT "DO YOU NEED HELP WITH THIS PROGRAM (*Y*=YES,*N*=NO)"
0070 INPUT C$
0080 IF C$="N" THEN 180
0090 PRINT "THIS PROGRAM COMPUTES THE COMPONENTS OF PROFIT"
0100 PRINT "RELATED TO THE PURCHASE OF AN APARTMENT BUILDING."
0110 PRINT "THE COMPONENTS OF PROFIT ARE GOI-GROSS OPERATING"
0120 PRINT "INCOME, NOI-NET OPERATING INCOME, CASH FLOW DR"
0130 PRINT "SPENDABLE INCOME, EQUITY INCOME, AND TAXABLE INCOME."
0140 PRINT "IN ADDITION, CAP RATE IS COMPUTED, AS WELL AS PRICE"
0150 PRINT "PER SQ FT.  PARAMETERS, SUCH AS MORTGAGE INTEREST"
0160 PRINT "RATES CAN BE VARIED TO SEE THEIR EFFECT ON THE "
0170 PRINT "PROFIT COMPONENTS."
0180 PRINT "WHAT IS THE YEARLY SCHEDULED GROSS INCOME?"
0190 INPUT G1
0200 IF Y=2 THEN 710
0210 PRINT "WHAT IS THE VACANCY ALLOWANCE IN PERCENT?"
0220 INPUT V1
0230 IF Y=2 THEN 710
0240 PRINT "WHAT IS THE EXPENSE RATIO (%) RELATIVE TO THE GOI?"
0250 INPUT E1
0260 IF Y=2 THEN 710
0270 PRINT "HOW MANY UNITS DOES THIS BUILDING HAVE?"
0280 INPUT N1
0290 PRINT "HOW MANY SQUARE FEET DOES THIS BUILDING HAVE?"
0300 INPUT F1
0310 PRINT "WHAT IS THE PROPOSED PURCHASE PRICE?"
0320 INPUT P1
0330 IF Y=2 THEN 710
0340 PRINT "HOW MANY MORTGAGES WILL THERE BE AGAINST THE PROPERTY?"
0350 Z=5
0360 INPUT J
0370 L=0
0380 PRINT "FOR BALLOON OR INTEREST ONLY MORTGAGES SET MONTHS=10000"
0390 FOR I=1 TO 4
0400 M(I)=0
0410 N(I)=0
0420 O(I)=0
0430 T(I)=0
0440 U(I)=0
0450 V(I)=0
0460 NEXT I
0470 FOR I=1 TO J
0480 PRINT "WHAT IS THE AMOUNT ($), TERM (MONTHS), "
0490 PRINT "AND INTEREST RATE (%) OF MORTAGE NUMBER "I
0510 INPUT M(I),N(I),O(I)
0520 L=L+M(I)
0530 NEXT I
0540 IF Y=2 THEN 710
0550 PRINT "FOR DEPRECIATION PURPOSES WHAT IS THE PERCENTAGE "
0560 PRINT "ALLOCATION TO THE BUILDING?"
0570 INPUT A1
0580 PRINT "PERCENTAGE ALLOCATION TO PERSONAL PROPERTY?"
0590 INPUT A2
0600 PRINT "WHAT IS THE DEPRECIATION METHOD TO BE USED ON THE BLDG"
0610 PRINT " ('DDB', 'SL', '125%')?"
0620 INPUT D$
0630 PRINT "BUILDING DEPRECIATION PERIOD IN YEARS?"
0640 INPUT Y1
0650 PRINT "PERSONAL PROPERTY DEPR - 'DDB', 'SL' ,'125%', '150%'?"
0660 INPUT H$
0670 PRINT "PP PERIOD IN YEARS?"
0680 INPUT Y2
0690 IF Y=2 THEN 710
0700 REM COMPUTE VACANCY $ AND GOI
0710 V2=(V1/100)*G1
0720 G2=G1-V2
0730 REM COMPUTE GROSS MULTIPLIER
0740 P6=P1/G2
0750 REM COMPUTE EXPENSE $ AND NOI
0760 E2=(E1/100)*G2
0770 G3=G2-E2
0780 C=G3
0790 REM COMPUTE PRICE RATIOS AND EQUITY
0800 P2=(G3*100)/P1
0810 P3=P1/N1
0820 P4=P1/F1
0830 P5=P1-L
0840 REM COMPUTE $ ALLOCATIONS TO BLDG AND PP
0850 A3=(A1/100)*P1
0860 A4=(A2/100)*P1
0870 IF D$<>"SL" THEN 900
0880 A5=A3/Y1
0890 GOTO 1080
0900 IF D$<>"DDB" THEN 930
0910 A5=(A3/Y1)*2
0920 GOTO 1080
0930 IF D$<>"125%" THEN 2140
0940 A5=(A3/Y1)*1.25
0950 GOTO 1080
0960 IF H$<>"SL" THEN 990
0970 A6=A4/Y2
0980 GOTO 1080
0990 IF H$<>"DDB" THEN 1020
1000 A6=(A4/Y2)*2
1010 GOTO 1080
1020 IF H$<>"125%" THEN 1040
1030 A6=(A4/Y2)*1.25
1040 GOTO 1080
1050 REM PUT IN RANGE TEST FOR DEPR METHOD?
1060 IF H$<>"150%" THEN 2160
1070 A6=(A4/Y2)*1.25
1080 A7=A5+A6
1090 REM COMPUTE INTEREST/PRINCIPAL AMOUNTS FOR MORTGS
1100 REM MONTHLY PAYMENT
1110 IF Z<>5 THEN 1280
1120 FOR I=1 TO J
1130 Q(I)=O(I)/1200
1140 T=(1+Q(I))^N(I)
1150 R(I)=(M(I)*Q(I)*T)/(T-1)
1160 NEXT I
1170 REM TOTAL FIRST YEAR INTEREST
1180 FOR I=1 TO J
1190 T1=0
1200 T3=M(I)
1210 FOR K=1 TO 12
1220 T2=T3*Q(I)
1230 T(I)=T(I)+T2
1240 T3=T3-(R(I)-T2)
1250 NEXT K
1260 NEXT I
1270 REM COMPUTE FIRST YEAR PRINCIPAL & CASH FLOW
1280 FOR I=1 TO J
1290 V(I)=R(I)*12
1300 U(I)=V(I)-T(I)
1310 C=C-V(I)
1320 IF N(I)<=900 THEN 1340
1330 U(I)=0
1340 NEXT I
1350 P7=(C/P5)*100
1360 REM COMPUTE EQUITY RETURN
1370 P8=0
1380 P9=0
1390 T1=0
1400 FOR I=1 TO J
1410 P8=P8+U(I)
1420 NEXT I
1430 T1=P8+C
1440 P9=(T1/P5)*100
1450 REM COMPUTE TAXABLE INCOME
1460 T=T1-A7
1470 PRINT
1480 PRINT
1490 PRINT "SCHEDULED GROSS"TAB(32-LEN(STR$(G1)))G1
1510 PRINT "VACANCY ("V1"%)"TAB(32-LEN(STR$(V2)))V2
1530 PRINT "       GOI"TAB(32-LEN(STR$(G2)))G2
1550 PRINT "EXPENSE RATIO ("E1"%)"TAB(32-LEN(STR$(E2)))E2
1570 PRINT "       NOI"TAB(32-LEN(STR$(G3)))G3
1590 PRINT "                FINANCING                    NOI"
1600 PRINT TAB(64-LEN(STR$(G3)))G3
1610 PRINT "MORTGAGE          1          2          3          4"
1620 PRINT "INTEREST      "TAB(24-LEN(STR$(T(1))))T(1)
1621 PRINT TAB(34-LEN(STR$(T(2))))T(2)TAB(44-LEN(STR$(T(3))))T(3)
1622 PRINT TAB(54-LEN(STR$(T(4))))T(4)
1640 PRINT "PRINCIPAL     "TAB(24-LEN(STR$(U(1))))U(1)
1641 PRINT TAB(34-LEN(STR$(U(2))))U(2)TAB(44-LEN(STR$(U(3))))U(3)
1642 PRINT TAB(54-LEN(STR$(U(4))))U(4)
1660 PRINT "TOTAL         "TAB(24-LEN(STR$(V(1))))V(1)
1661 PRINT TAB(34-LEN(STR$(V(2))))V(2)TAB(44-LEN(STR$(V(3))))V(3)
1662 PRINT TAB(54-LEN(STR$(V(4))))V(4)
1680 PRINT TAB(36)"CASH FLOW ("P7"%)"TAB(64-LEN(STR$(C)))C
1700 PRINT TAB(36)"PRINCIPAL"TAB(64-LEN(STR$(P8)))P8
1720 PRINT TAB(36)"EQUITY RTN("P9"%)"TAB(64-LEN(STR$(T1)))T1
1740 PRINT TAB(36)"DEPRECIATION"TAB(64-LEN(STR$(A7)))A7
1760 PRINT TAB(36)"TAXABLE"TAB(64-LEN(STR$(T)))T
1780 PRINT "PURCHASE PRICE="P1"LOAN AMOUNT="L"EQUITY="P5
1800 PRINT "CAP RATE BASED ON PRICE= "P2"%   "GROSS MULTIPLIER= "P6
1820 PRINT "PRICE/UNIT= "P3"      PRICE PER SQ FT= "P4
1840 PRINT
1850 PRINT
1860 PRINT
1870 PRINT "DO YOU WISH TO 1-DISPLAY CURRENT VALUES, 2-CHG A VALUE ,"
1880 PRINT "3-RERUN PROGRAM, 4-DONE"
1890 INPUT K
1900 Y=K
1910 IF K=4 THEN 2340
1920 IF K=3 THEN 60
1930 IF K=2 THEN 1970
1940 IF K=1 THEN 2180
1950 PRINT "PLEASE INPUT 1,2,3,OR 4"
1960 GOTO 1890
1970 PRINT
1980 PRINT "DO YOU WISH TO CHANGE:"
1990 PRINT "1- SCHEDULED GROSS INCOME"
2000 PRINT "2- VACANCY ALLOWANCE"
2010 PRINT "3- EXPENSE RATIO"
2020 PRINT "4- PURCHASE PRICE"
2030 PRINT "5- MORTGAGE INFORMATION"
2040 PRINT "6- DEPRECIATION INFORMATION"
2050 INPUT Z
2060 IF Z=1 THEN 180
2070 IF Z=2 THEN 210
2080 IF Z=3 THEN 240
2090 IF Z=4 THEN 310
2100 IF Z=5 THEN 340
2110 IF Z=6 THEN 550
2120 PRINT "PLEASE INPUT A NUMBER BETWEEN 1 AND 6"
2130 GOTO 2050
2140 PRINT "PLEASE INPUT 'SL', 'DDB' OR '125%'"
2150 GOTO 600
2160 PRINT "PLEASE INPUT 'DDB', SL , 125% OR '150%'"
2170 GOTO 650
2180 PRINT
2190 PRINT
2200 PRINT "BUILDING HAS "N1" UNITS AND "F1" SQ FEET"
2220 PRINT "BUILDING ALLOCATION= "A1"%  PERSONAL PROPERTY= "A2"%"
2240 PRINT "BLDG TAKEN UNDER "D$" DEPRECIATION OVER "Y1"YEARS"
2260 PRINT "PERSONAL PROPERTY TAKEN UNDER "H$" DEPR OVER "Y2"YEARS"
2280 FOR I=1 TO J
2290 PRINT "MORTGAGE "I"="M(I)"OVER  "N(I)" MOS AT "O(I)"%"
2310 NEXT I
2320 PRINT
2330 GOTO 1870
2340 PRINT "THANK YOU"
2350 END

READY
```

Card of

Cañada Systems, Inc. —

Or — How To Tell Time

By Roger Edelson, Hardware Editor

Cañada Systems CL2400 Real Time Clock is an S-100 bus compatible time of day clock. The CL2400 is a self-contained time keeping unit that once set continually updates the time without requiring any processor time. The CL2400 uses line frequency as its time standard. The board also provides the generation of periodic interrupts which can be enabled at any of six different rates, all under software control. Before we get into the kit, its functions, and construction there is one major shortcoming of the CL2400 — power must be "ON" to the computer for the clock to function. If you turn off your computer you lose the time of day. This could be easily rectified by a battery backup and the inclusion of a CMOS oscillator. There is plenty of room available on the board to provide this feature and as an option it would not greatly increase the board cost. Be that as it may, let's take a look at what the CL2400 does do — and does well at a reasonable price ($135.00 assembled; $98.00 as a kit).

Time of day is continually provided to the computer without requiring any processor overhead. The time of day is provided in 24 hour mode as six BCD digits, one each of six I/O ports. The digits are arranged as H_tH_u:M_tM_u:S_tS_u. That's tens of hours, hours; tens of minutes, minutes; etc. As mentioned, six different interrupt rates (once per second, 10 sec, 1 minute, 10 minutes, 1 hour, or once very 12 hours) are provided and can be selected by software control.

The CL2400 is initialized under program control, with commands for HOLD, SET HOURS, SET MINUTES, Enable/Disable Interrupts, Acknowledge/Reset Interrupt, and Interrupt Rate Select all available. The CL2400 uses eight sequential I/O ports which are user selectable to any of ten base addresses. The Real Time Clock card is S-100 bus compatible and uses bus line 64 as the input for the 60 Hz signal. The card requires only 300ma (max.) from the + 8V line and less than 50 ma from the + 16V supply. The reference manual provided is extremely comprehensive and software examples are included to indicate the ease with which the device may be initialized and used. Set and Read routines are supplied that will operate with any BASIC system with I/O capability (INP and OUT statements).

Before covering the theory of operation of the Real Time Clock, let's see what the kit itself is like. As representative of the Cañada Systems, Inc. kits that I have seen, the assembly manual is well written and sufficiently detailed. The board is well made with tinned printed circuit traces and gold-plated edge connectors for reliability. There is no solder masking, which caused me to make one trace-to-trace short. The short was easy to find before power was applied so no harm was done. The component identification by silk screening is almost non-existent, however the assembly diagram is more than adequate. The assembly layout drawing provides complete layout information and the part values are provided at the top of the drawing rather than on another parts-list page. This makes assembly easy despite the fact that the layout drawing is found in the reference manual. Alright, I agree that is where it should be *after* construction, and it is nice not to have to flip pages, but how about two assembly drawings. (picky, picky).

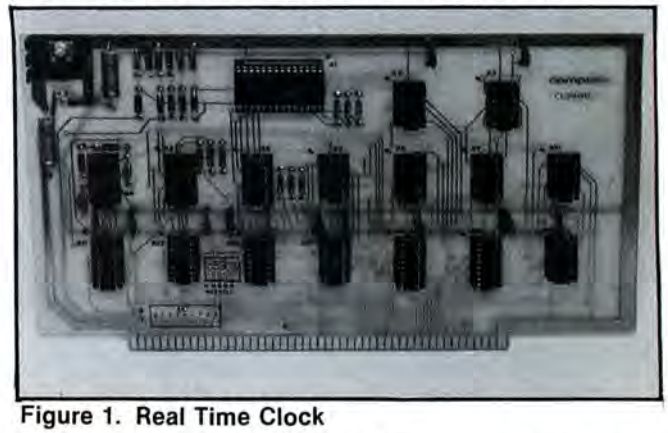


Figure 1. Real Time Clock

Assembly is very easy, the board is fully socketed, and a heat sink is provided for the regulator. I think I spent about ½ hour from start to finish. A picture of the CL2400 assembled is shown in Figure 1. Adequate instructions are provided for selecting the ten possible starting addresses for the CL2400. I would prefer a DIP switch to the hardwire selection, but the peculiar selection logic mitigates against this. The CL2400 address selection is associated with Bus address lines A11 through A15, and requires that any two of the selection jumpers be set to a low state, while the remaining three jumpers are set to a high state. Figure 2 illustrates the standard CL2400 addressing which uses I/O ports A8 through AF. The following table illustrates the address jumper selection for each of the ten possible starting addresses.

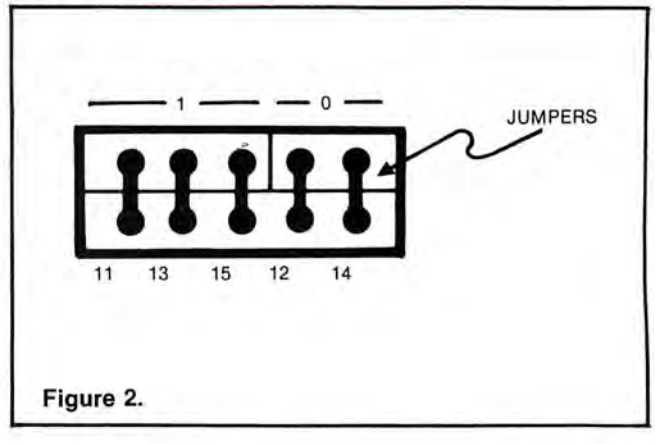


Figure 2.

the Month

CL2400 Real Time Clock

With Your Computer

ADDRESSES USED

Octal	Hex	ADDRESS LINES HIGH (1)	ADDRESS LINES LOW (0)
070-077	38-3F	11, 12, 13	14, 15
130-137	58-5F	11, 12, 14	13, 15
150-157	68-6F	11, 13, 14	12, 15
160-167	70-77	12, 13, 14	11, 15
230-237	98-9F	11, 12, 15	13, 14
250-257	A8-AF	11, 13, 15	12, 14
260-267	B0-B7	12, 13, 15	11, 14
310-317	C8-CF	11, 14, 15	12, 13
320-327	D0-D7	12, 14, 15	11, 13
340-347	E0-E7	13, 14, 15	11, 12

( ) Address Jumper

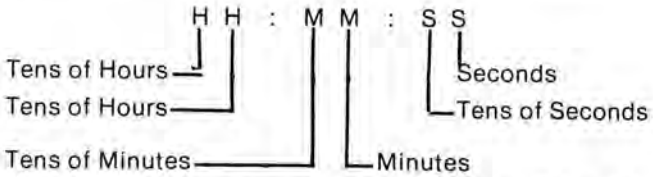
The checkout procedure is relatively simple but extensive enough to locate most of the faults. The first portion of the checkout is performed prior to the insertion of the MOS clock chip in order to prevent damage to the chip if the board is not correct. This portion of the checkout verifies correct operation of the address decoding and buffer circuitry. If this portion of the board operates correctly the MOS clock chip is then plugged in. Extensive safety precautions are detailed to minimize possible damage to the MOS chip by improper installation. After the clock chip has been installed the next set of checkout instructions check the clock for proper operation. The trouble shooting portion of the manual is quite good and should help locate almost any possible fault.

Figure 3 provides a look at the schematic of the CL2400. Basically there are four sections of the CL2400: 1) the address decoding circuitry and the control register (A15 and ½ A10); 2) the time keeping circuitry (mainly the MM5318 and the 60Hz input circuitry; 3) the data input circuitry; and 4) the interrupt circuitry.

Bus address lines A11 through A15 are presented to ICs A12 and A13 through the five address jumpers. CL2400 ADDR (A13 pin) goes high whenever address lines A15 through A8 contain an address that satisfies the three high and two low requirements of the jumpers and A12 and A13. Gate A7 "ANDS" the SINP bus signal to create a READ (A7 pin 3) signal. READ enables the A16 and A11 input data drivers whenever the computer inputs from a peripheral address within the block of 8 CL2400 addresses. Additional sections of A12 and A13 "AND" SOUT and PWR signals to establish a WRITE (A8 pin 6) signal. If the computer outputs data to CL2400 base address +, +2, +3, +5, +6, or +7 (+0 and +4 are eliminated by gate A7 pin 11), a 7-bit register consisting of A15 (data out bits D00-D05) and one half of A10 (D06) is strobed by A7 pin 8. Latched data bits 0-2 from A15 are presented to the mode control inputs of A1. Bits 3-5 determine the interrupt rate, and bit 6 (stored in A10) serves as the interrupt enable signal.

Bus address lines A8, A9 and A10 are presented to the digit select inputs of A1 through sections of A14 and A11 ICs whenever the computer reads the clock. Transistors contained in A6 convert TTL signal levels to the 12 volts required by A1.

The MM5318 IC, A1, contains all counters required to take a 60Hz input and keep the present time in six digit hours, minutes, seconds, (BCD) format as follows:



This requires digit select logic for selection of the digit to be read. The MM5318's digit select codes (pins 26, 27, and 28) are as follows:

Z Pin 28	Y Pin 27	Z Pin 26	Digit
12 v	12 v	12 v	Tens of hours
12 v	12 v	GND	Hours
12 v	GND	12 v	Tens of minutes
12 v	GND	GND	----------
GND	12 v	12 v	Seconds
GND	12 v	GND	Tens of seconds
GND	GND	12 v	Minutes
GND	GND	GND	----------

Control over the MM5318 counters is obtained with the HOLD (pin 16), SET MINUTES (pin 17), and SET HOURS (pin 18) signals from the control register. HOLD inhibits advancing of the counters, SET MINUTES advances the seconds counter at a 60Hz rate, and SET HOURS advances the minutes counter at a 60Hz rate. The 60Hz input to the MM5318 is derived from the computer's + 16 volt supply transformer. A 60Hz signal from the transformer is routed from bus pin 64 to a half-wave rectifier consisting of D2, D3, and R1. R3, R4, C3, and C4 then filter line transients from the signal before it is presented to A1 pin 19. D4 ensures that the input 60Hz signal does not exceed the 12 volt supply created by R2, D1, and C2.

The BCD digit selected by address lines A8, A9 and A10 is available on pins 2-5 of A1, after a delay required for internal decoding. To allow for this delay, one-shot A4 is triggered each time a clock digit is read. Pin 13 of A4 causes a 3-4 microsecond pulse that enables a section of A11 to pull down the processor XRDY line. The XRDY signal is synchronized with the 02 clock externally (on the processor board).

The BCD digit is inverted by A2 and enabled onto bits DI0-DI3 when the READ signal is active. BIts DI4 and DI5 are always forced to 0, and bits DI6 and DI7 are forced to 0 by A8 pin 2 and A7 pin 11, respectively, unless address 310 or 314 is being used. Since CL2400 base address and base address + 4 do not return a BCD digit from the MM5318, they are used to return interrupt enable status in bit DI6 and interrupt pending status in bit DI7.

When the clock is not being read, IC A5 gates the interrupt rate code from the control register (A15 pins 12,

7, and 10) to the digit select inputs of A1. This selects one of the six time digits to appear at the MM5318 BCD output. The least significant bit (LSB) of this digit is clocked by the PSYNC signal into IC A9. A3 then makes a comparison between the present state of the LSB, and the previous state stored in A9 pin 12. If a change occurs, A3 pin 3 makes a low to high transition, which clocks pin 3 of A10 to set the interrupt flip-flop, IC 10 pin 5. If INTERRUPT ENABLE (A10 pin 9) is active, A17 pin 11 pulls down the selected but interrupt line. To guard against erroneous setting of the interrupt flip-flop, the interrupt circuitry is disabled each time the clock is read. The READ signal from A8 pin 4 fires one-shot A4, causing pin 12 to go low for sixteen microseconds. This disables the PSYNC signal from changing the stored LSB, and disables the change signal from setting the interrupt flip-flop.

Once the interrupt flip-flop is set, it must be cleared by a program statement. Any output to CL2400 base address or base address + 4 is decoded by A8 pin 2, which is ANDED with the WRITE signal by A17. Pin 3 of A17 clears the interrupt flip-flop.

Programming of the CL2400 is quite easy. The card uses relative addressing of the inputs and outputs with respect to the base address which is established by hardwires on the board. The following table gives the relative addressing of the CL2400 inputs and outputs.

	OUTPUT	INPUT
Base Address	Interrupt Acknowledge	Interrupt Status
Base Address + 1	Control Register	Minutes (0-9)
Base Address + 2	—	Tens of Seconds (0-5)
Base Address + 3	—	Seconds (0-9)
Base Address + 4	—	—
Base Address + 5	—	Tens of Minutes (0-5)
Base Address + 6	—	Hours (0-9)
Base Address + 7	—	Tens of Hours (0-5)

At the base address + 1 the control register is loaded by outputting an 8-bit word. In bit position 0 of this word a "1" will cause the clock to hold its last reading. The clock will resume operation when a "0" is placed in this bit position. A "1" in the bit position 1 will cause the clock to count at a rate 60 times faster than normal operation. At this speed the minute counter will change every second. A "0" in this bit position causes the clock to resume normal speed. Likewise, a "1" in position 2 causes the hour counter to change once per second to facilitate setting of the hour digits. An "0" placed in this bit position causes the clock to resume normal speed. Bit positions 3 through 5 are used to set the interrupt rate. Two faster rates than normal ones (16.7ms and 167 ms) may be obtained by placing the clock in the SET MINUTES mode. Of course the clock will not keep the correct time when used in this mode. If a "0" is outputted in bit position 6, the clock is inhibited from generating any interrupts. A "1" enables the CL2400 internal interrupt signal. Once the CL2400 interrupt flip-flop has been set, it must be acknowledged by the processor before it will reset. The processor resets the interrupt flip-flop by placing any output on the base address. Bits 6 and 7 of the base address indicate the status of the CL2400 interrupt subsystem. Bit 6 provides an indication of the interrupt enable flip-flop and bit 7 indicates the present state of the interrupt flip-flop.

Time is presented in the four least significant bits of the addresses base + 1 through base + 7. However, base + 4 does not contain any information.

Sample programs are provided in both BASIC and 8080 machine language to guide the user in utilizing the clock.

All-in-all the CL2400 is very easy to build and to use. Programs may be written which allow the use of the computer to time many chores in the household without burdening the processor with the overhead of time keeping.

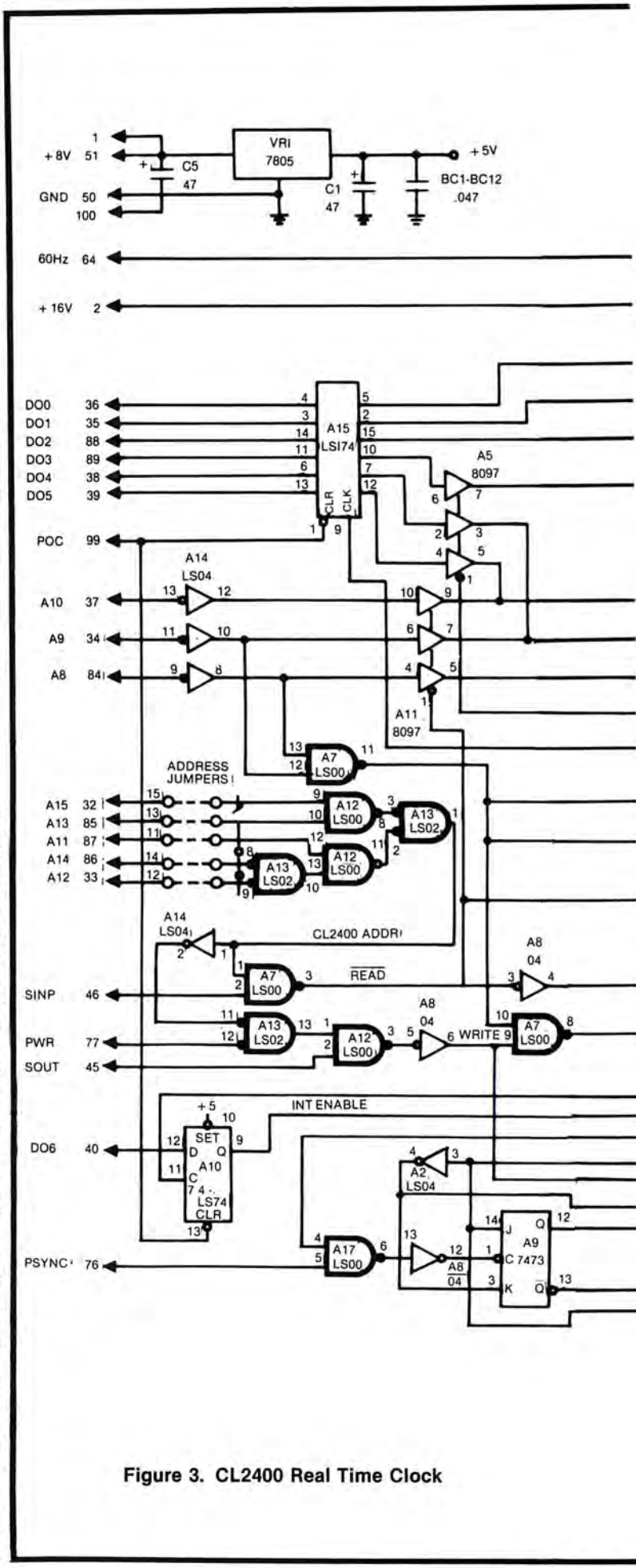
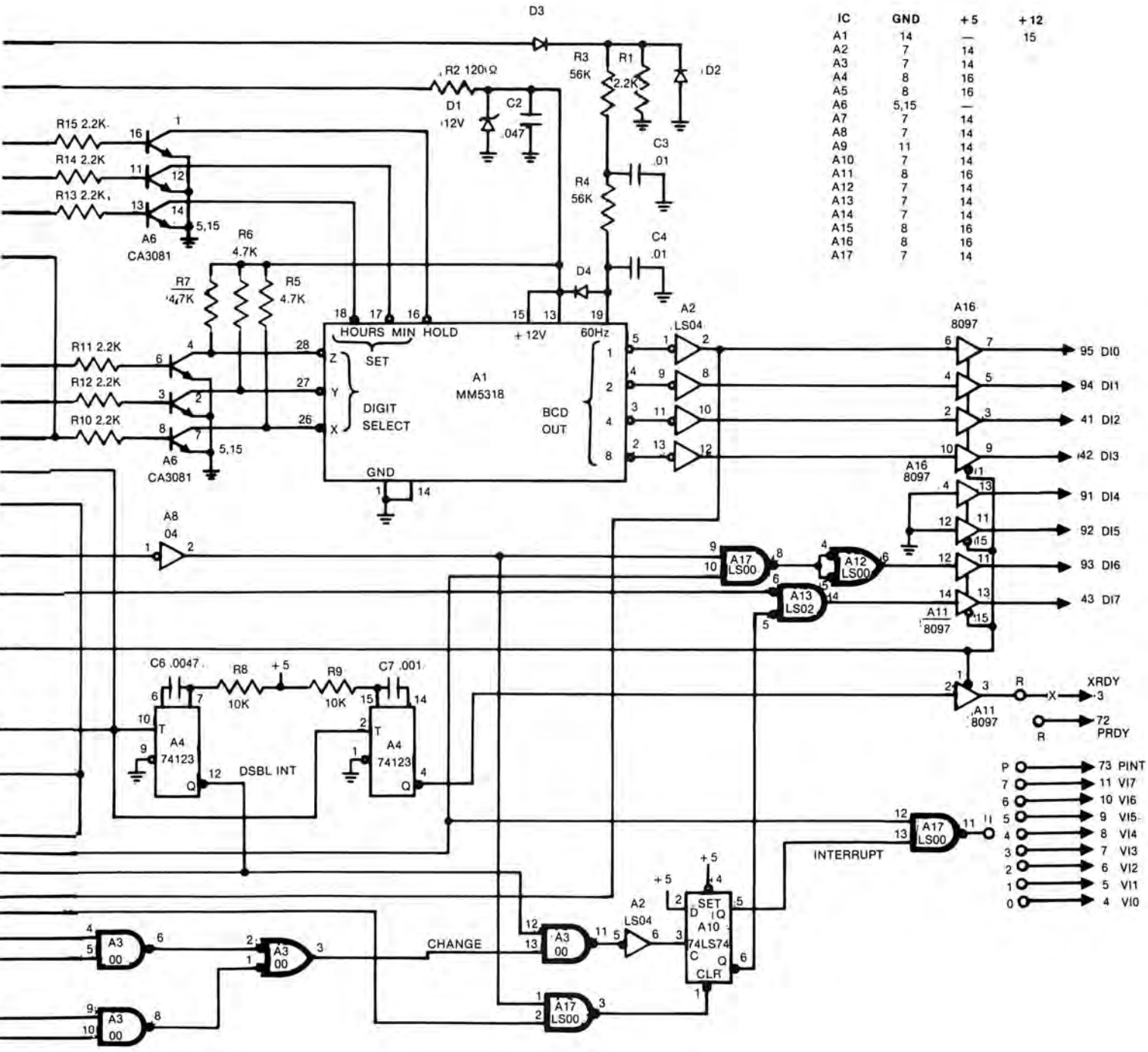


Figure 3. CL2400 Real Time Clock



IC	GND	+5	+12
A1	14	—	15
A2	7	14	
A3	7	14	
A4	8	16	
A5	8	16	
A6	5,15	—	
A7	7	14	
A8	7	14	
A9	11	14	
A10	7	14	
A11	8	16	
A12	7	14	
A13	7	14	
A14	7	14	
A15	8	16	
A16	8	16	
A17	7	14	

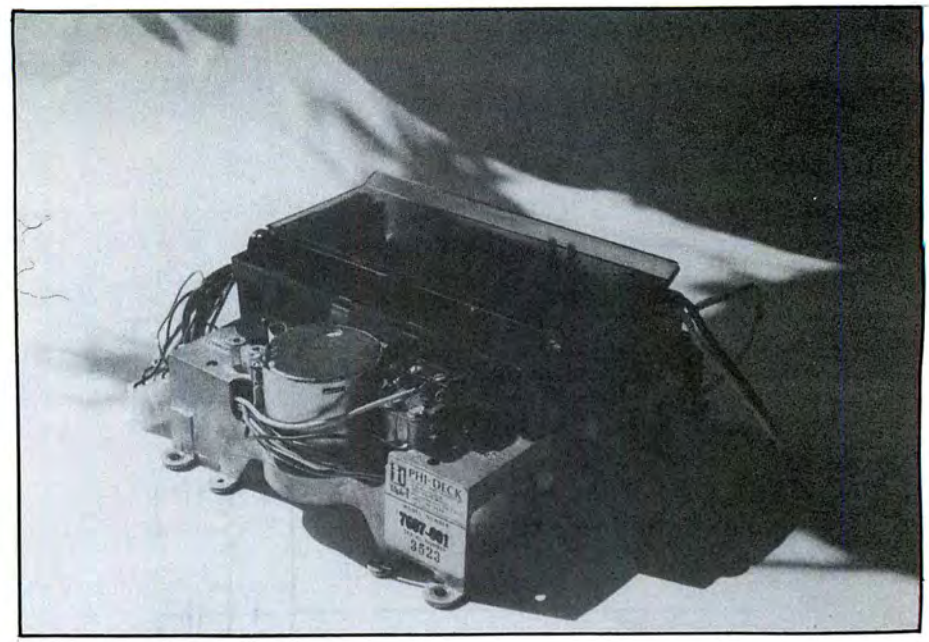


PHOTO 1 Phi-deck Capstan motor placement.
Photo by Jim Henderson.

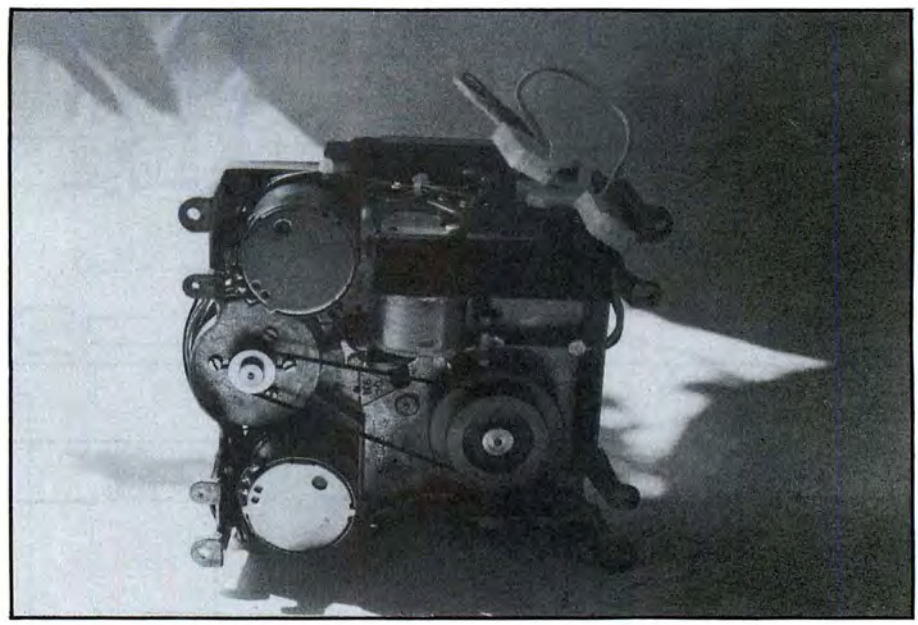


PHOTO 2 Phi-deck rewind/forward and head motor placement. Photo by Jim Henderson.

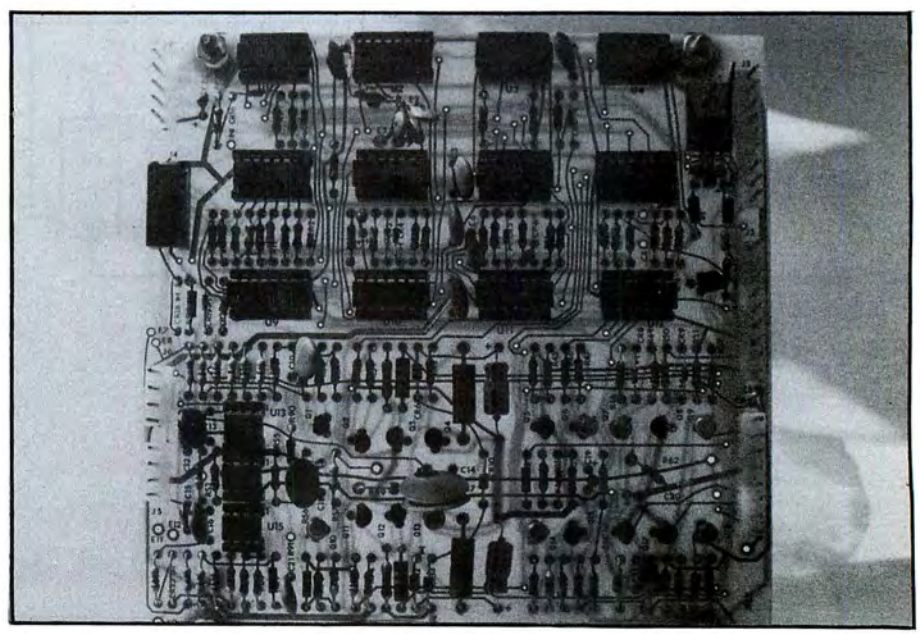


PHOTO 3 Control card. Photo by Jim Henderson.

Turning Toward MECA

By Carl Denver Warren II

BACKGROUND

About three years ago two young engineers named Derryl and Don Millican set out to devise an inexpensive mass storage system for the then "new" personal computers. Don Millican had the experience needed, having designed read/write circuitry for IBM for several years; Derryl had the research and marketing knowhow. Finally after two years of extensive research and design work, their dream came true in the form of a high speed cassette system which they dubbed the MECAdrive.

Their next objective was to design a kit which was reliable and could compete with the growing floppy disc market. The remainder of this article is an indepth description of the drive, theory of operation, assembly, and possible user application.

THE PHI-DECK

The MECAdrive is made up of two distinct parts, the most obvious part being the tape drive mechanism. The Phi-deck, manufactured by Triple I, was chosen for its reliability, base construction, and ease of control. The Phi-deck shown in Photo 1 has four motors for controlling each of the needed functions.

In Photo 1 you can see the capstan motor placement in relationship to the cassette holder. The capstan motor is driven any time power is applied to the Phi-deck. This motor is not switched because of the time it takes to come up to speed, approximately one second. However, if it becomes necessary to keep the drive powered even though it is not in use, provisions have been made on the control card to switch the capstan motor on and off. The capstan motor speed is an integral part of the Phi-deck and can be changed by changing the size of the pulley. The pulley arrangement for the Phi-deck is shown in Photo 2. Notice the belt driving arrangement from the capstan motor to the capstan spindle drive pulley.

The forward and rewind motors are placed on either side of the capstan motor as shown in Photo 2. The motors are wired so that positive current drives the forward motor to advance the tape and the rewind motor to rewind the tape. These motors are powered from a 7V source and move the tape at an average speed of 100 inches per second. To prevent excessive speed near the end of the tape, the non-driven motor is dynamically braked to slow the tape before reaching the stops. The control of these motors is a function of the printed circuit control card which I will discuss later, but it is necessary to look at the schematic of the card in Figure 1 to see how the forward and rewind motors are controlled.

As shown in Figure 1, the forward and rewind motors are interfaced with 2N4400 type transistors in a Darlington circuit to provide sufficient current gain to drive Q3 and Q12 into saturation. During the play mode, Q4 is turned on so that R43 is used to reduce the current supplied to the motor which reduces the torque and insures a gentle takeup action. When the drive is switched from fast forward, rewind, play, or stop, Q13 turns on for a moment to power both motors and take up any slack.

The last motor on the Phi-deck is the head motor, which is shown in Photo 2 opposite the capstan spindle pulley. This motor is powered by an 11V source because of the high torque required to raise the head assembly. The motor on the deck is a DC motor rather than an AC stepping motor to reduce the cost of the unit. However, the motor must be dynamically braked to keep it from coasting and going into the disengaged position. This is accomplished by shorting the positive lead to ground for a short time through Q5. The head position is sensed by a microswitch on the side of the unit by the starwheel mechanism. As shown in Figure 1, the head and play signals are input to an exclusive circuit which engages or disengages the motors as required.

CONTROL CARD

The control card shown in Photo 3 is a densely packed, high quality, double sided printed circuit board that provides the following functions:

A) Control of the four motors;
B) Write circuitry (2 channels);

PHOTO 4 Phi-deck and control card mounted.
Photo by Jim Henderson.

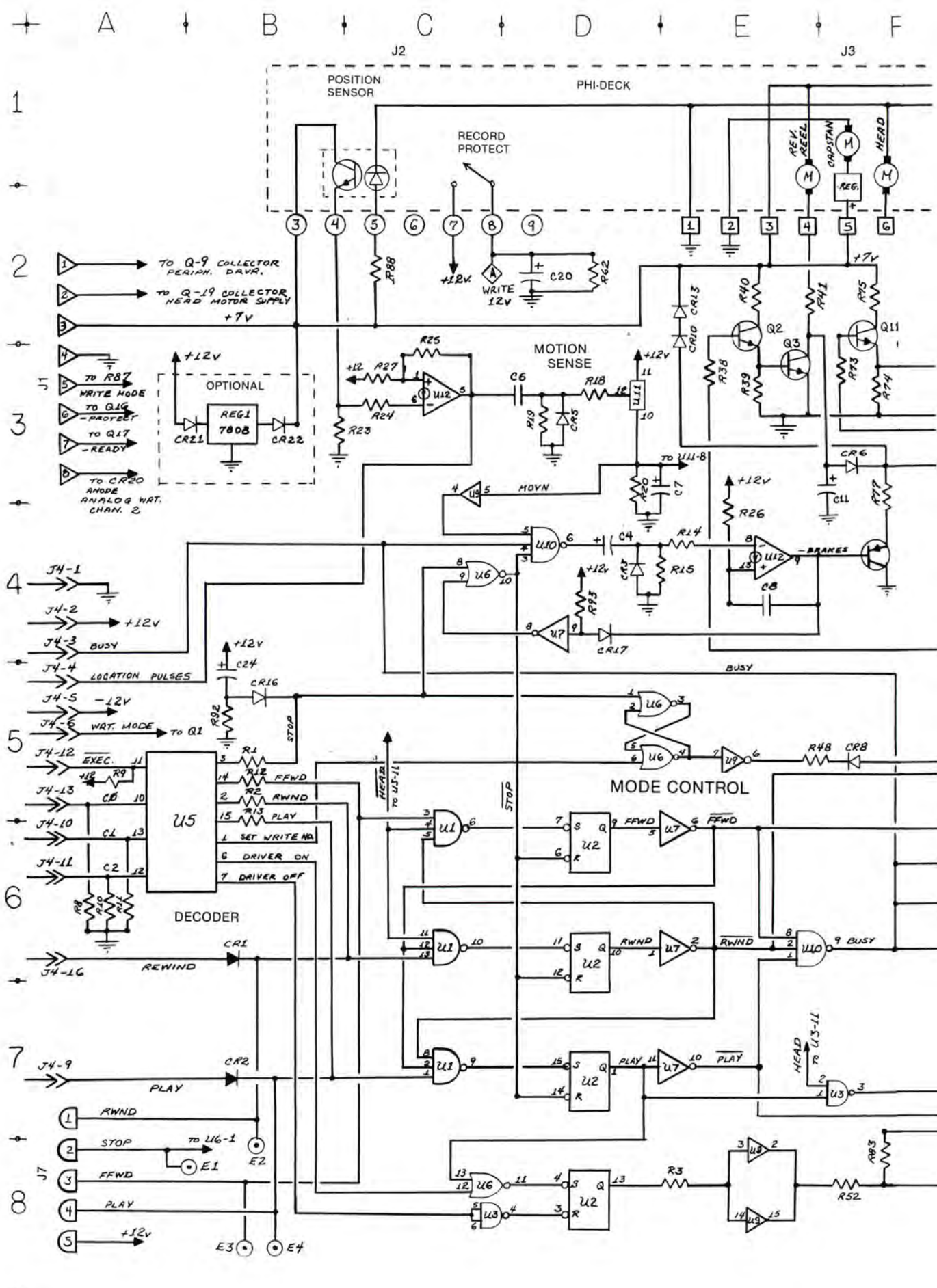
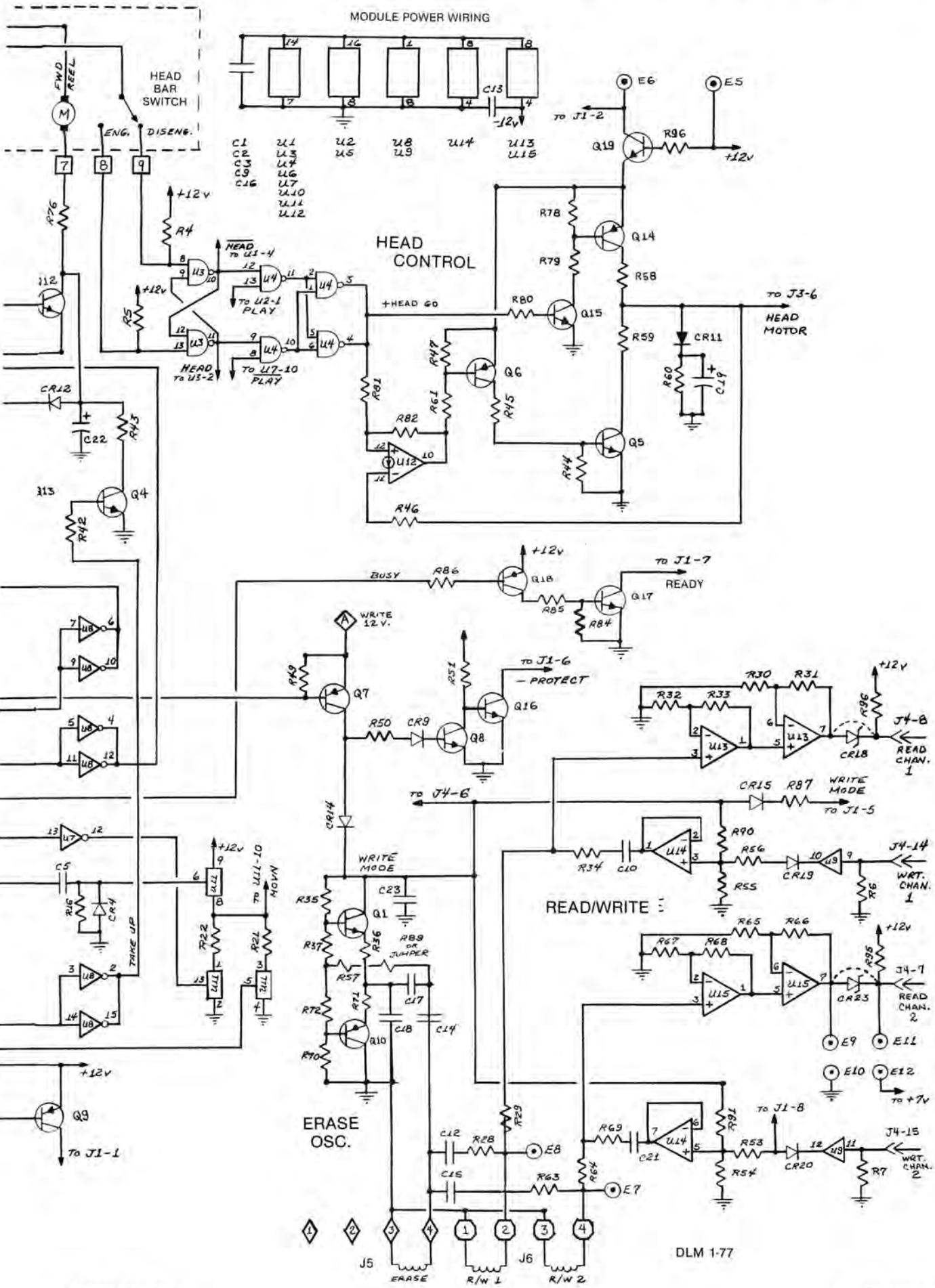


Figure 1. Schematic of Meca Drive.


MODULE POWER WIRING
HEAD BAR SWITCH
FWD REEL
ENG.
DISENG.
HEAD CONTROL
+HEAD GO
TO J3-6
HEAD MOTOR
TO J1-2
TO J1-7
READY
BUSY
WRITE 12V.
TO J1-6
– PROTECT
WRITE MODE
TO J4-6
TO J1-5
READ/WRITE
ERASE OSC.
TAKE UP
TO J1-1
TO J1-8
READ CHAN. 1
WRT. CHAN. 1
READ CHAN. 2
WRT. CHAN. 2
TO +7V
J5
J6
ERASE
R/W 1
R/W 2

DLM 1-77

C) Read circuitry including preamplification;
D) Interface for computer and manual operation.

As shown in Photo 4 the card is mounted beneath the Phi-deck so that all functions are easily plugged in.

As I mentioned in the discussion of the Phi-deck, the motor control is handled by the control card. The card also senses the motion of the tape and uses it to determine tape end in order to reset all the latches. It also makes the pulse train, generated by the tape motion, available at I/O connector J-4 for use in determining tape position. In the application section of this article I will discuss how the pulse train is used in determining file location on the tape.

The *read/write* circuitry, as shown in Figure 1, is located in the lower right hand portion of the schematic. The *read* circuit has preamplifiers to minimize outside noise sources. This also provides an 800 mV rms signal at low impedance so the signal can be run for long distances without interference. The *read* circuits are identical, with the amplifiers designed to be tailored by the user for desired gain.

The *write* channels consist of U14 (dual 1458 op-amp) which supplies the actual record signal. This signal current is mixed with the bias current at the *read/write* head and provides enough drive to saturate fully the tape. This is AC-biased writing rather than DC and provides for better tape saturation.

The *erase* oscillator, located on the schematic to the left of the *read/write* circuitry, is composed of transistors Q1 and Q10 and uses the head as an inductor in an LC oscillator. The frequency is approximately 55 kHZ and 45V peak, giving total AC erasure on both channels 1 and 2.

The rest of the circuitry on the card is for decoding input commands and setting the mode of operations. Also, the card allows for *write* protecting by turning the *write* circuitry 12V off, thus protecting the cassette. The *write* mode can be detected at connector J1-5. This shows when the collector voltage of Q1 is approximately 11V, the drive is in *write* mode. Table 1 shows the functions available at I/O connector J4 and the signal types.

The control of the MECAdrive is accomplished by setting up three control bits with a fourth bit for execution. This allows for more than one drive to be on the bus at the same time with only the drive whose execute pin is taken low accepting the commands. Table 2 shows the necessary bit patterns for a desired function.

I/O CONNECTOR PIN OUTS AND CONTROL BIT FUNCTIONING

The I/O connector J4 on the control card provides for interfacing to the chosen computer system through any 8-bit port. Table 1 shows the function of each pin and signal types that are either available or required. Pins J4-10, 11, and 13 are the computer control bits and are decoded to determine the function to be performed. However, the function is inhibited until J4-12 execute is taken low. Table 2 shows the code function translation. The *execute* pin J4-12 is negative true and causes the command on the bus to be executed. This allows commands to more than one drive to be bused with only the one whose *execute* is negative to execute the command. Also, it allows the instruction to "set up" in the decoder before it is gated out to prevent any glitches or bit loss. Figure 2 is a block diagram of a multiplexed system of three drives to demonstrate this function.

POWERING THE MECADRIVE

Figure 3 is a block diagram of the power requirements of the MECAdrive. A positive 12V is required for the logic circuits, any LED indicators, and peripheral driver Q19. The 11V needed for the head motor is derived through the resistor transistor network R94 and Q19 to provide

	POWER	SIGNAL TYPE
J4-1	Ground	Power
J4-2	+ 12V	Power
J4-5	– 12V	Power
	DRIVE OUTPUTS	
J4-3	+ Busy	Logic
J4-4	Position Pulses	Logic
J4-6	+ Write Mode	Logic
J4-7	Chan 2 Read	Analog
J4-8	Chan 1 Read	Analog
	DRIVE INPUTS	
J4-9	Play	Logic
J4-10	C1	Logic
J4-11	C2	Logic
J4-12	Execute	Logic
J4-13	C0	Logic
J4-14	WRT CH 1	Logic or Analog
J4-15	WRT CH 2	Logic or Analog
J4-16	RWND	Logic

Table 1. I/O connector J4 pinouts and functions (courtesy of MECA).

C2	C1	C0	FUNCTION
0	0	0	Stop
0	0	1	Fast Forward
0	1	0	Rewind
0	1	1	Play
1	0	0	Set Write Mode
1	0	1	Set Peripheral Driver On
1	1	0	Set Peripheral Driver Off
1	1	1	Not used.

NOTE: All operational state transitions must be made via the stop mode, i.e.

Fast Fwd → Stop → Rewind
Play → Stop → Rewind
Write → Stop → Fast Forward
Play → Stop → Fast Forward
— etc. —

This is *not true*, however, for the Set Write Mode to Play Sequence. Since stop resets write mode, you *should not* issue a stop command after setting write mode until you wish to reset write mode.

Table 2. Code to function translation (courtesy of MECA).

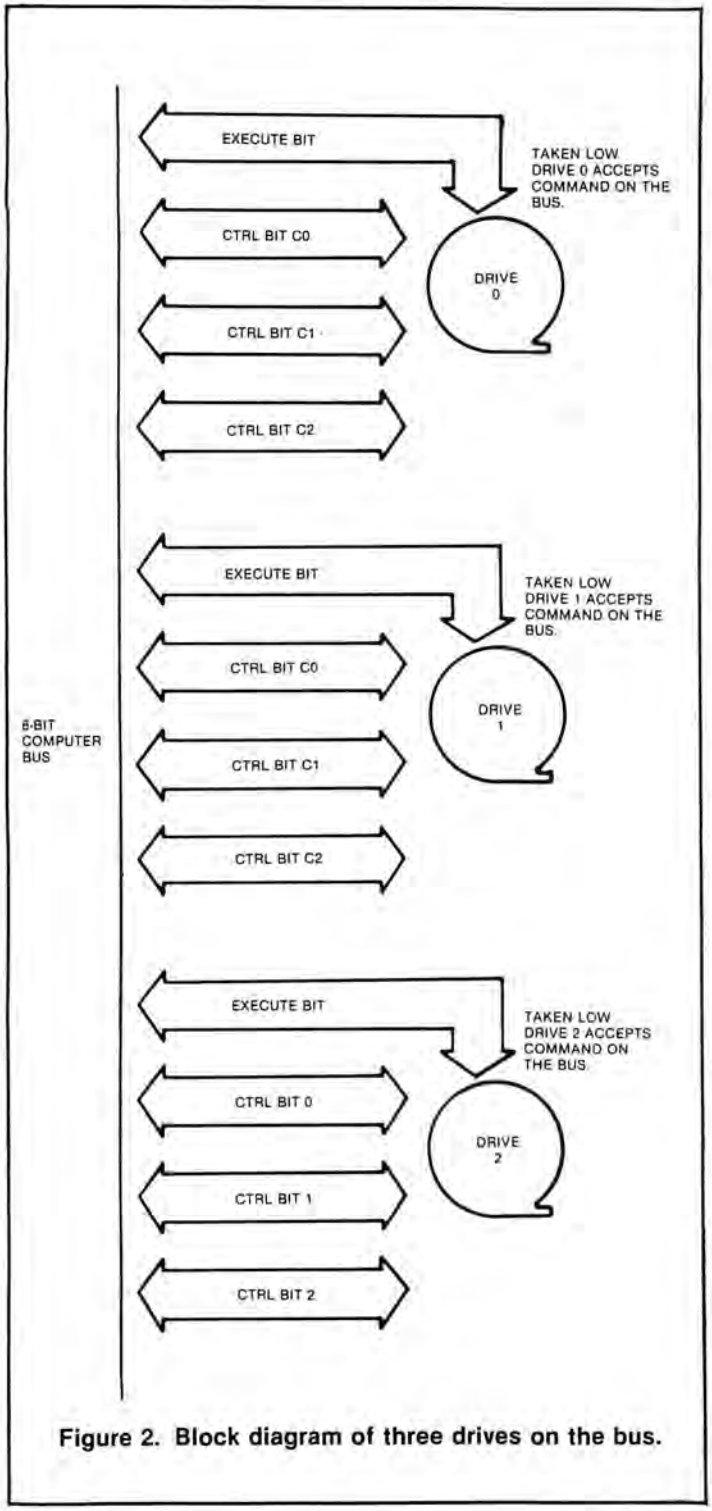


Figure 2. Block diagram of three drives on the bus.

sufficient gain to raise the head. The 7808 voltage regulator is optional and provides an on-board method of creating the 7V needed for the capstan and reel motors. By using the regulator, an extra 7V outboard power supply is not needed.

As the basic MECAdrive system stands, a power supply is not provided. However, in the user/assembly manual power supply options are offered. Figure 4 is a schematic of a dual 12V supply designed to handle all the power requirements of the MECAdrive.

ASSEMBLY

The assembly of the MECAdrive kit requires a fair amount of experience on the part of the builder. Although the assembly manual covers the assembly procedure in detail, it is written for the experienced kit builder.

The MECAdrive is made up of the Phi-deck and the control card. The Phi-deck is supplied by MECA completely wired, with all connectors made up and seated in their molex holders. The control card is the main building project. Figure 5 is the component side of the PC board. You will notice that the entire circuitry is placed on the card in a very compact manner. Consequently, when assembling this unit, care must be taken to avoid mis-position of components.

The components in the kit are of first quality with sockets for all the ICs. Every item in the kit, from resistors to the Phi-deck, are guaranteed and will be replaced if defective. However, the chances of getting bad parts in the kit are almost nonexistent since Don takes every precaution to insure that a kit is of first quality before it is shipped.

OPTIONS AVAILABLE

Throughout this article I have been describing the basic MECAdrive system, that is the Phi-deck and control card. Like all peripherals on the market, other options can be purchased.

The MECAdrive system is designed to fit in with the S 100 type computers either interfacing through a PIA arrangement with your design or through the Tarbell interface. MECA also has made available an interface card which handles all the I/O transfers and housekeeping needed to operate the MECAdrive. This interface, along with the MECAdrive, makes up the entire top of the line MECA system which is called the Alpha-1 system. Since I am oriented toward the 6800-based machines, I have not made myself familiar with the Alpha-1 and, therefore, cannot really describe it. Hopefully, someone with an S100 machine using the Alpha-2 system will describe it in a future article.

One question you are probably asking is if there is a cabinet or not. The answer is both yes and no. The system is designed to be inexpensive, so if you want a cabinet, you can design your own. If you are handy with sheet metal, you can probably do it for just a few dollars. However, if you want a sharp-looking cabinet, it can be purchased separately for $70.00. The only drawback is that there is only one cabinet size, shown in Photo 5, and that is for a dual drive. However, after using the MECAdrive for about ten minutes you will want the second drive.

Derryl has designed the MECAdrive package to be flexible so that you can purchase it just about any way you want. Table 3 is a summary of the options available and price breakdowns. Derryl also has personally visited all major MITS dealers around the country to set them up as MECA dealers. Each dealer has a complete up and running system with many different types of demo programs and more coming. Also, each dealer has been given a full indoctrination to the system so that they can answer any questions you may have. More importantly, they have the system so you can walk out the door with one today.

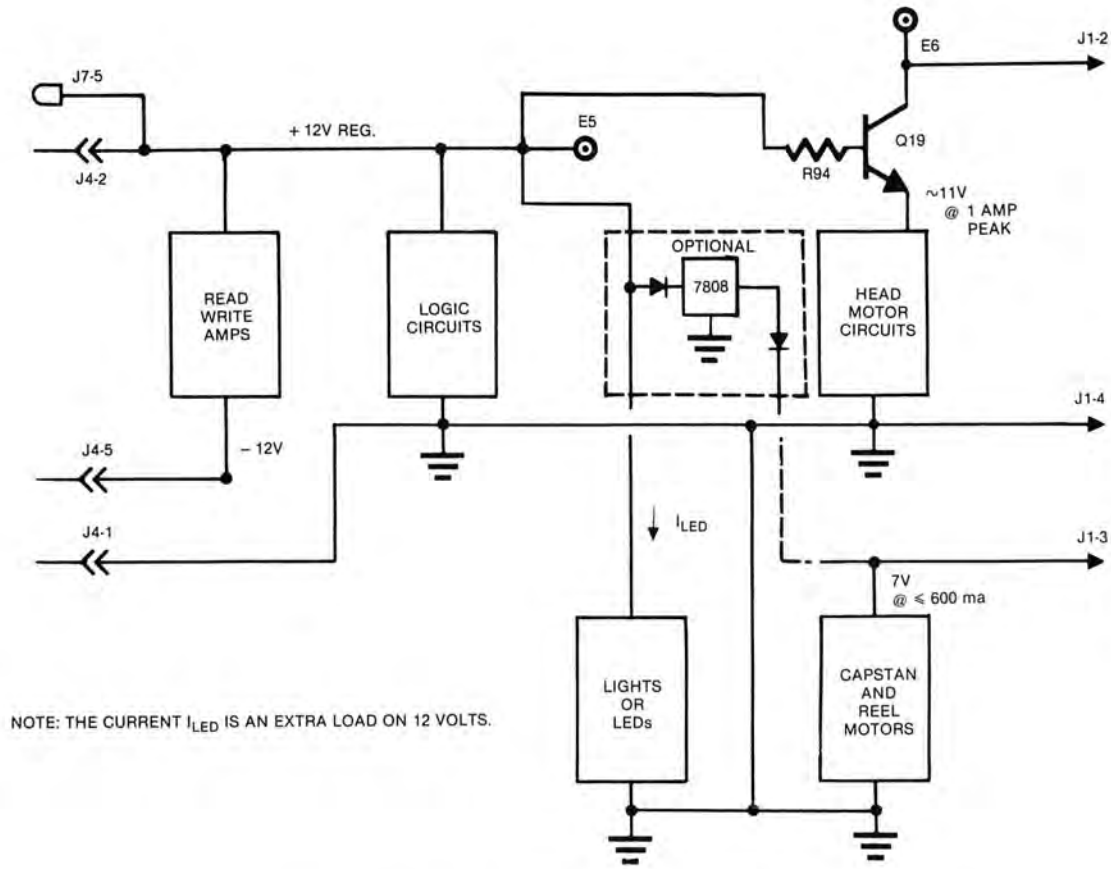


Figure 3. Block diagram of power requirements (courtesy of MECA).

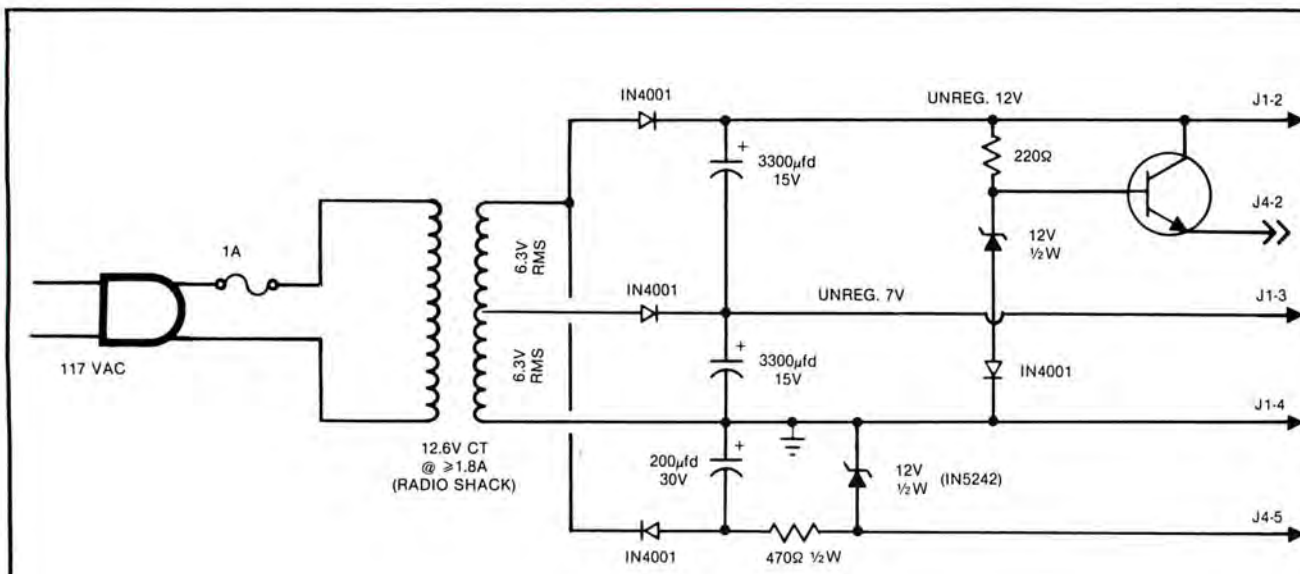


Figure 4. Power supply schematic (courtesy of MECA).

PHOTO 5
Dual drive cabinet.
(Courtesy of MECA)

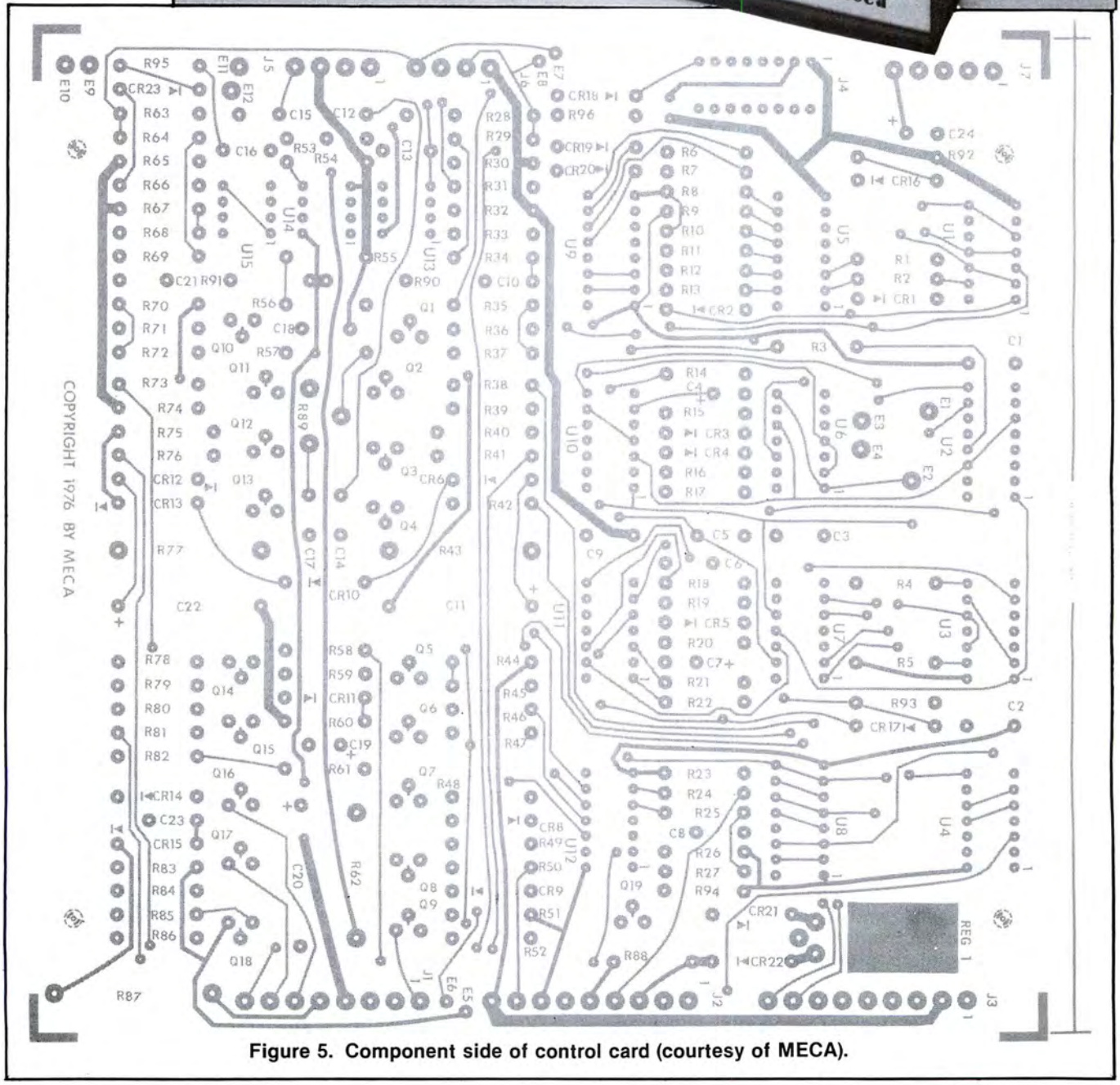


Figure 5. Component side of control card (courtesy of MECA).

Option	Kit	Assembled
Basic system—Phi-deck and control card	$240.00	$320.00
Single drive power supply, enclosure	$395.00	$595.00
Complete system — dual drives, controller, enclosure, manual, operating system	$685.00	$965.00
Enclosure		$ 70.00
Manual		$ 5.00
Power supply	$ 20.00	$ 27.00

Prices for the entire Alpha-1 system can be obtained directly from Meca.

Table 3. Options available and price breakdowns.

APPLICATIONS

Any peripheral device is only good if it can be used to perform some sort of useful task and, of course, this is true of the MECAdrive. For the purposes of this discussion, I would like briefly to touch on the following areas: file naming and file search, mailing lists, library lists, and basic business applications.

File naming and file search can be accomplished with the MECA using the feature of counting the pulses generated by the tape motion, since the pulse generator is located on the forward takeup reel and produces 18 pulses per revolution. The relationship of the tape on the reel and the pulse received is non-linear, because of the radius of the takeup reel changing with the amount of tape on it. Using the figures in Table 4, you can design a tape operating system that will determine where a file is on the tape, name it by type and location, and when needed search for it by that file name location indicator.

For mailing lists, it is estimated that approximately 5000 names and addresses can be contained on the average C60 cartridge. Using this and rapidly filling a buffer area from the MECAdrive with variable length files, you can write a mailing list routine. Also, using two drives you can merge, sort, delete, and add new names.

A library list is not names of all the local libraries, but it could be. For our purposes, it is usually a list of what is available on a tape or group of tapes and the access code needed to get to them. This is also sometimes called menu. An example of this function can be seen at most of the MECA dealers around the country.

Basic business applications are, to me, the most exciting and important area of personal computing. With the hardware available today, business systems can be written to cover just about every aspect needed using minimal size memories and using the MECAdrive as a virtual memory device. For example, an inventory package can be written that does the following: a) gives online status of inventory balances; b) differentiates fast movers from slow movers; c) flags out of stock items; d) allows for comprehensive inventory reports.

Accounts receivable and payable packages can also be written to handle incoming and outgoing invoices, handle check registers, give detail reports of balances for both categories, and also flag late bills. Finally, a general ledger system can be implemented to update all journal entries, keep track of accounts, and produce periodic reports covering any detail that you desire.

The MECAdrive makes all this possible by providing a 1 megabyte mass storage system that can be manipulated in the same manner as the larger super systems. The MECAdrive offers another unique aspect in that it can also be used as an audio recorder which provides for an interesting concept in computer instruction. Both CRT and auditory commands can be used to tutor the user.

INS.	COUNT	INS.	COUNT	INS.	COUNT	INS.	COUNT
0	420	1100	11921	2200	20417	3300	27476
20	681	1120	12094	2220	20556	3320	27595
40	939	1140	12267	2240	20695	3340	27714
60	1194	1160	12439	2260	20833	3360	27832
80	1445	1180	12609	2280	20970	3380	27950
100	1695	1200	12779	2300	21107		
120	1942	1220	12948	2320	21244		
140	2186	1240	13116	2340	21380		
160	2428	1260	13283	2360	21515		
180	2668	1280	13449	2380	21651		
200	2905	1300	13615	2400	21786		
220	3141	1320	13780	2420	21921		
240	3374	1340	13944	2440	22054		
260	3605	1360	14108	2460	22188		
280	3833	1380	14270	2480	22321		
300	4060	1400	14433	2500	22454		
320	4285	1420	14593	2520	22587		
340	4509	1440	14754	2540	22719		
360	4730	1460	14914	2560	22851		
380	4950	1480	15073	2580	22982		
400	5167	1500	15231	2600	23113		
420	5383	1520	15389	2620	23243		
440	5598	1540	15547	2640	23373		
460	5811	1560	15703	2660	23503		
480	6022	1580	15859	2680	23633		
500	6232	1600	16014	2700	23762		
520	6440	1620	16169	2720	23891		
540	6647	1640	16323	2740	24019		
560	6851	1660	16477	2760	24147		
580	7055	1680	16631	2780	24274		
600	7256	1700	16783	2800	24402		
620	7457	1720	16935	2820	24529		
640	7655	1740	17087	2840	24655		
660	7853	1760	17237	2860	24781		
680	8049	1780	17387	2880	24907		
700	8245	1800	17537	2900	25033		
720	8438	1820	17686	2920	25158		
740	8631	1840	17835	2940	25283		
760	8823	1860	17982	2960	25407		
780	9013	1880	18130	2980	25531		
800	9203	1900	18277	3000	25655		
820	9391	1920	18423	3020	25779		
840	9579	1940	18569	3040	25902		
860	9765	1960	18714	3060	26025		
880	9949	1980	18859	3080	26148		
900	10133	2000	19003	3100	26270		
920	10316	2020	19147	3120	26393		
940	10499	2040	19289	3140	26514		
960	10679	2060	19432	3160	26635		
980	10860	2080	19574	3180	26756		
1000	11039	2100	19716	3200	26877		
1020	11217	2120	19857	3220	26997		
1040	11394	2140	19998	3240	27117		
1060	11571	2160	20138	3260	27237		
1080	11746	2180	20278	3280	27357		

Table 4. Lineal tape location to pulse count conversion (courtesy of MECA).

SUMMARY

Always at the end of an article you wonder if you have covered everything, or at least everything that is import ant, but in most cases something has been left out. Therefore, if you are really interested in the MECAdrive system, the entire user/assembly manual can be purchased for $5.00 by writing to MECA, Attn: Nancy Millican, 7026 Old Woman Springs Road, P.O. Box 696, Yucca Valley, CA 92284, or phone (714) 365-7686. I plan in a future article to discuss interfacing the system to the MITS 680b bus and the rudiments of a TOS for the system.

The Glass Teletype
A Flexible Television Interface

By Charlie Mitchell, Phil Roybal, Keith Winter
National Semiconductor Corporation

INTRODUCTION

Over the past several years, the plunging prices of microprocessors and memory have steadily expanded the range of application for these devices. Now prices have dropped so low that the science-fiction concept of a personal computer, a genie in the home that does the bidding of an average person, has come within reach. It is expected that such a dream might come true for a fair percentage of the U.S. population within three to five years.

Unfortunately, the prices of peripheral devices have not dropped nearly as rapidly as the price of electronics. Today a microprocessor the size of a finger nail has more computing power than a roomful of computation equipment of a decade ago. Yet without some moderately expensive peripherals around it, that very powerful processor is a blind-deaf-mute; it can't read, it can't talk, it can't listen. Since electronics are cheap and mechanical devices are expensive, one solution for the problem of communication has been to utilize electronic devices wherever possible to replace mechanical ones. Thus, the TV Typewriter, the *Glass Teletype*, has come to be. The Glass Teletype or TVT is a device that allows the use of a television set or video monitor as an output device, and a simple switch matrix or encoded keyboard as an input device, to make up a basic terminal. Such a terminal provides one of the least expensive means for the user to conduct a dialog with his computer system. This article is a description of a TVT designed at National Semiconductor. It is a general-purpose board controlled by an SC/MP microprocessor, and it displays on a television set or video monitor the input taken from one of three sources:

1. Parallel Encoded Keyboard
2. Serial Source (ASCII, Baudot, etc.)
3. SC/MP Low-Cost Development System (LCDS)

Using its serial input and output interfaces, the circuit presented in this article can replace a teletype or video terminal. It can interface with a serial 20mA loop or RS232 line and thus handle all the functions normally provided by a teletype or CRT terminal.

HARDWARE

The system shown in block diagram (Figure 1) splits up into three parts:

1. Video RAM/Character Generator Logic
2. TTL Video Output Control Logic
3. Microprocessor Character Input Control Logic

Let's start with the microprocessor section which includes the processor itself, its control firmware; and the support logic that connects the processor to the outside world. The purpose of this part of the circuit is to control the loading of characters into the video RAM from the sources mentioned above. The SC/MP microprocessor control section is shown in Figure 2.

The microprocessor itself (U30) is the center of the figure. Below it are U38 and U39, bipolar PROMs which hold the application firmware that runs the video interface. Each PROM is 512 x 4, so together they make up ½K byte of storage.

The processor is connected to the rest of the system through a set of buffers and bus transceivers (U29, U33 and U44). Its bidirectional data bus is passed through the DP8304 bus transceiver (U33) and thus communicates with the video RAM holding characters to be displayed on the screen. SC/MP access to that RAM and to the rest of the system is controlled by the address bus through TRISTATE[R][1] bus drivers U29 and U44.

Information is brought into the system from a variety of sources. A typical source is an ASCII encoded keyboard consisting of a switch matrix keypad and an MM5740 encoder. The encoded output of the keyboard is connected through a DIP socket (U31) into an 81LS95 buffer, and then into the data bus of the SC/MP II microprocessor itself.

Another possible input is a serial data stream interfaced to the SC/MP by means of flag and sense lines. On the far left of Figure 2, connector 37 (B-SENSE) is attached to the SENSE B input pin of the SC/MP microprocessor, one of two sensing pins that can be tested under program control. A serial bit stream from a teletype or a communications line would be brought into this pin and would appear to the SC/MP as a series of pulses separated in time. The SC/MP would count time intervals, determine when a pulse should be there, and by testing SENSE B determine whether there was a 1 or 0 during that pulse time window. Serial output from the system is available through FLAG 0, a line that can be set under program control by the SC/MP. FLAG 0 is brought out through buffer U37 to pin 32 (BFLAG0) on the edge of the card.

A third input for the video card is the SC/MP Low-Cost Development System (LCDS). A DP8301 bidirectional interface (U34) is used to connect the SC/MP data bus with the bus of the LCDS. The card's I/O address is determined by a DM8131 address comparator (U40). U40 compares the contents of the address bus on the SC/MP LCDS with a predetermined address which is set up on U41, a DIP switch.

The system is configured for one of these input options by means of the firmware in PROMs U38 and U39, and also by means of the jumpers which are shown in Figure 2. To facilitate input there is an input control line (USER 1) at pin 8. USER 1 is a signal which is high when data have been inputted to the card but not been accepted, and low when the data have been accepted. Thus, an external device feeding this card can determine when the card has accepted data. USER 1 is controlled by the STD pin on U34 (for LCDS inputs) or by flip flop U17 (for keyboard inputs).

Since the card was designed to handle a variety of applications, there are other items in the circuit which may or may not apply to the particular application, and whose function can be changed under software control. One of these is switch S1, which is connected to the SIN pin of the SC/MP microprocessor. This pin provides a voltage level at the serial input to the processor. In the

[1]Tristate® is a reg. trademark of National Semiconductor Corp.

teletype emulation firmware used for our demo, that switch was used to select speeds of 110 or 300 baud for serial transmission. However, the switch means exactly what the firmware says it means, so the user can use it for anything he likes.

Another application-dependent item on the diagram is capacitor C1 on the INIT line. If the video card is used as part of a SC/MP Low-Cost Development System, that capacitor can be removed entirely. For other applications, the size of the capacitor should be adjusted to provide proper initialization of the SC/MP.

At the upper right of Figure 2, the address lines ($\overline{ASC}$, $\overline{AS0}$, $\overline{AS4}$ and $\overline{AS8}$) which are decoded from addresses 10 and 11 are used to select among input ports, ROMs, video RAMs, and READ/WRITE functions. Further down, BAD0-BAD7 and BD0-BD7 provide addresses and data to the video RAMs.

The TTL control circuitry (Figure 3) refreshes the display by providing a continuous stream of addresses to the video RAM bank. These addresses select the RAM location of the particular character to be displayed. That character is then supplied to the character generator (U28 in Figure 4) which paints a series of dots on the screen corresponding to the particular line of the character to be displayed. However, when the microprocessor is updating the RAM, it is necessary to prevent the control circuitry from selecting the RAM cell which is being modified. If this were not done there could be a broken character or garbage displayed upon the screen. To prevent this, as a particular RAM cell is changed by the microprocessor, $\overline{AS8}$ (which selects the video RAM WRITE function) is wire-ORed with the video signal (through U10 in Figure 3) and blanks it during the time that character should be displayed. The effect on the screen is of a momentary flicker as the character vanishes for a single frame. To the eye the effect is not discernible.

The TTL control circuitry is itself controlled by the dot clock, a master timing signal for all of the video circuitry. The dot clock determines when spots of a character will be illuminated during one line of the raster scan. The dot clock is fed into a dot counter, which counts out seven dots of the 7x9 matrix that the character occupies. Five dots are the character itself (in 5x7 dot format), followed by two dots of blank space. U6, a DM74LS163, is responsible for maintaining that count. The counter itself is reset by the PROM U12, whose job it is to know that a "character" for this system is five dot spaces and two blank spaces wide.

For each character produced, the character counter (U1 and U8) is incremented by one until it counts off either 32 or 64 characters on a line (the limit selected by the user). PROM U2 resets U1 and U8 at the end of the selected number of characters in the line.

The result of all these counting operations is a series of control signals which are supplied to the video RAM and character generation circuitry to control the image on the screen. One of these signals is the line rate clock, which is supplied directly to character generator U28, to determine when it is time to stop outputting one dot line of a character and begin outputting the next.

Another control signal is the vertical synch pulse, which indicates that a frame is complete and the CRT should begin vertical retrace. Likewise, horizontal synch is sent out to indicate the end of a line of dots so the CRT can begin horizontal retrace. These vertical and horizontal synch signals are imposed upon the video to make up the composite video signal which is fed to the monitor.

The last of the control signals are the addresses for the video RAM itself. These addresses (BAD0 to BAD9) count out on the lower left-hand side of Figure 3.

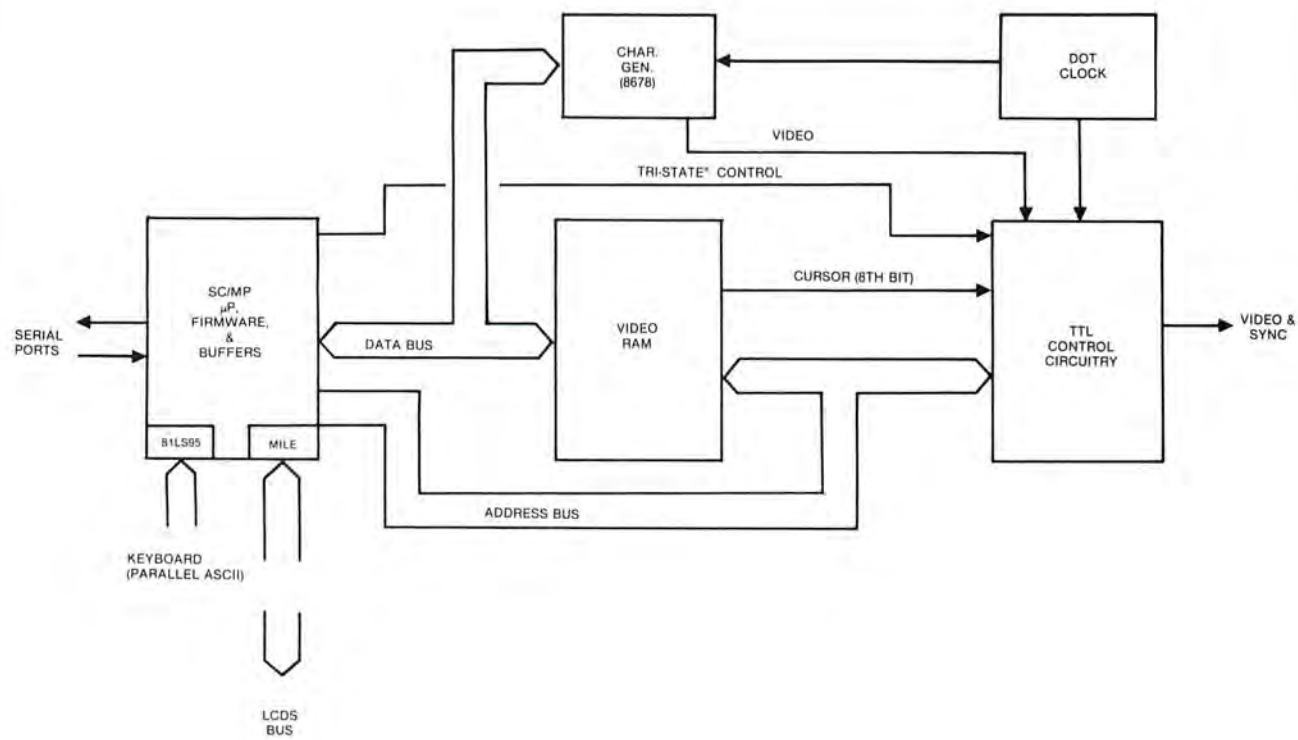


Figure 1. System Block Diagram

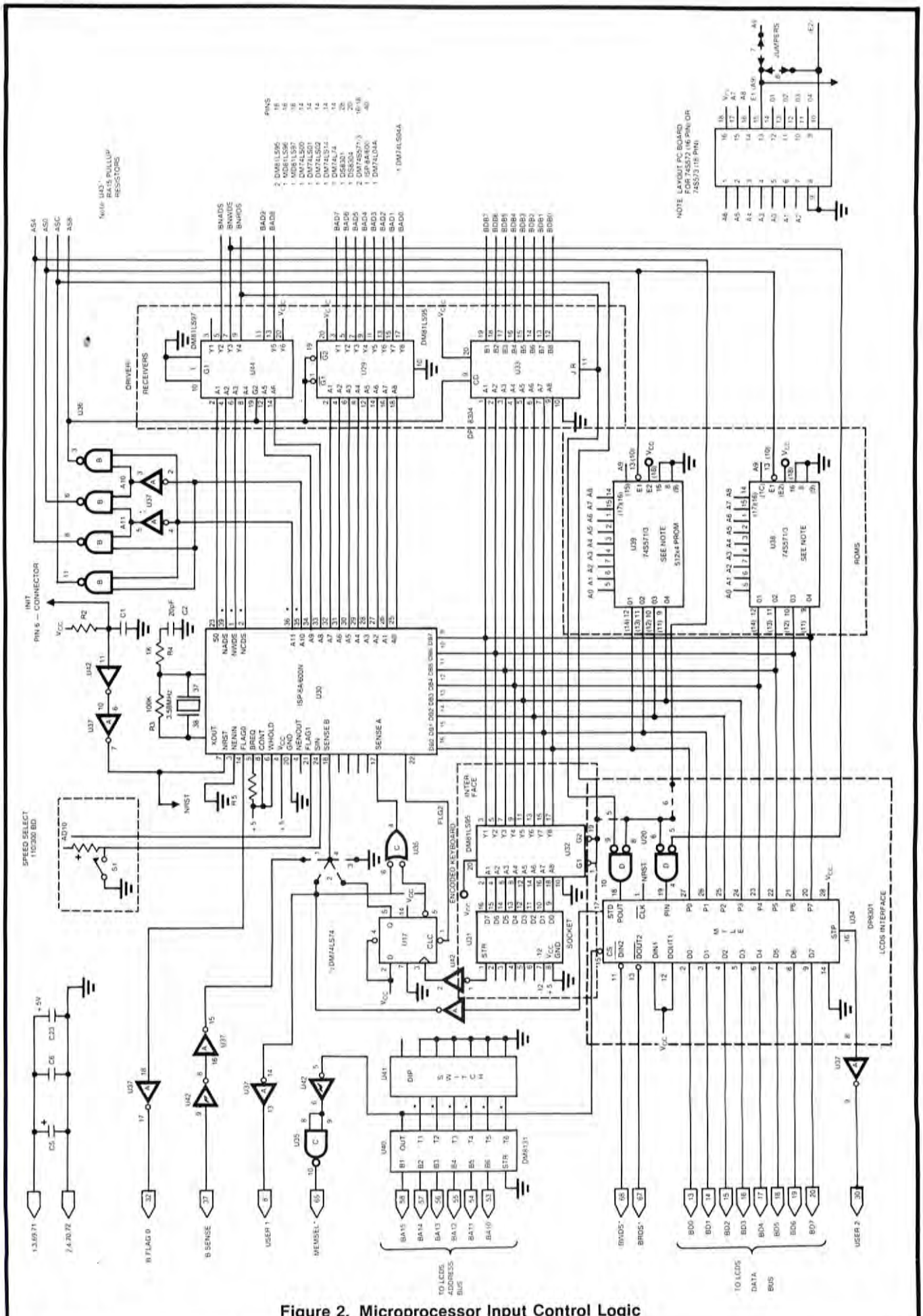


Figure 2. Microprocessor Input Control Logic

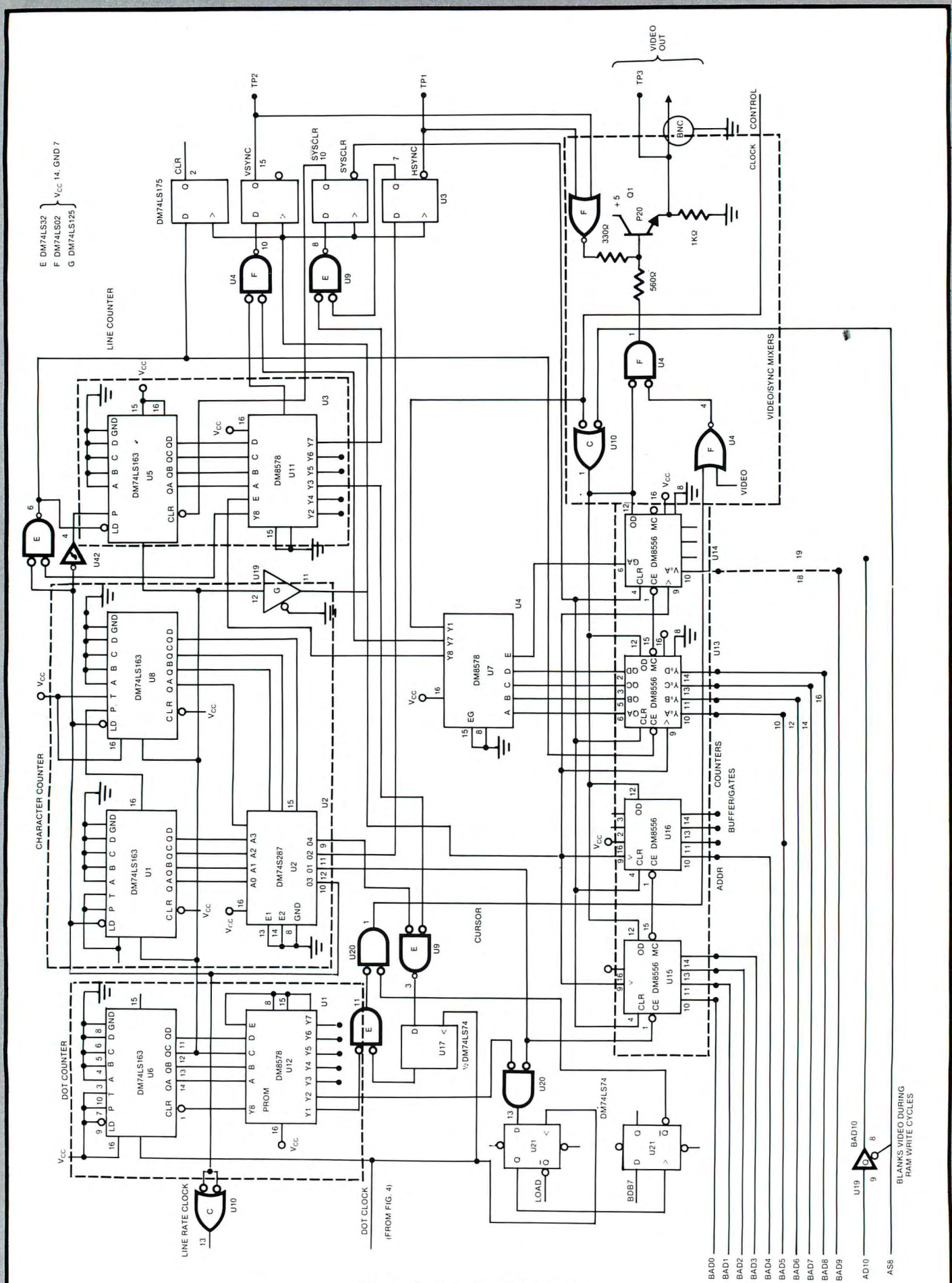


Figure 3. TTL Control Circuitry

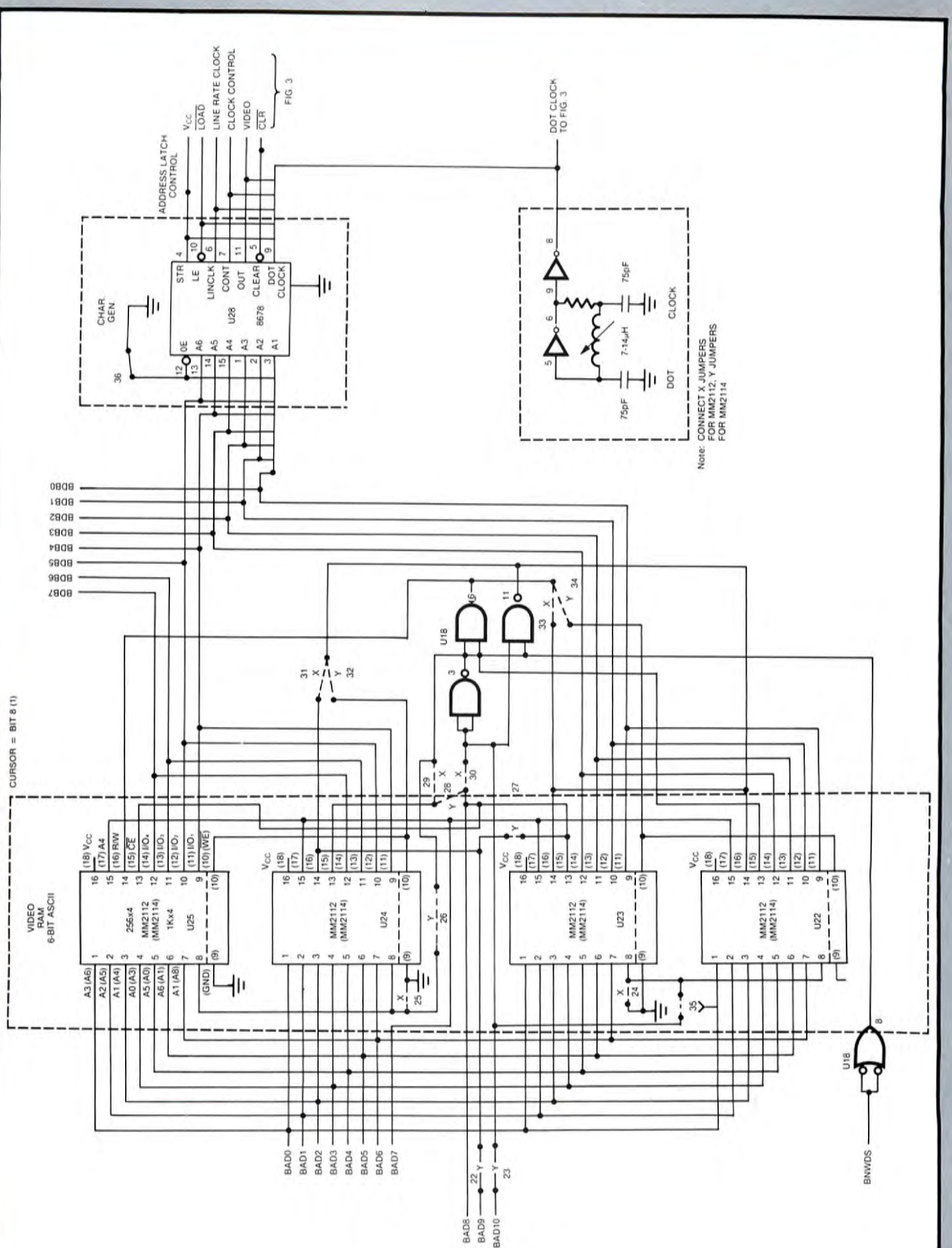


Figure 4. Video RAM and Character Generator.

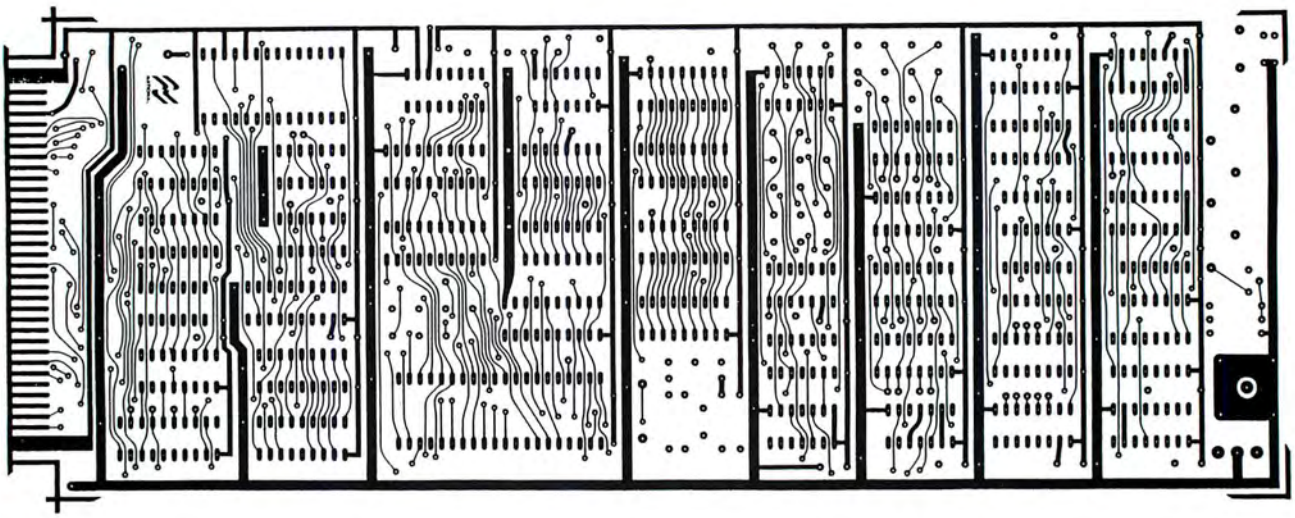


Figure 5.
(58.5% of Actual Size)

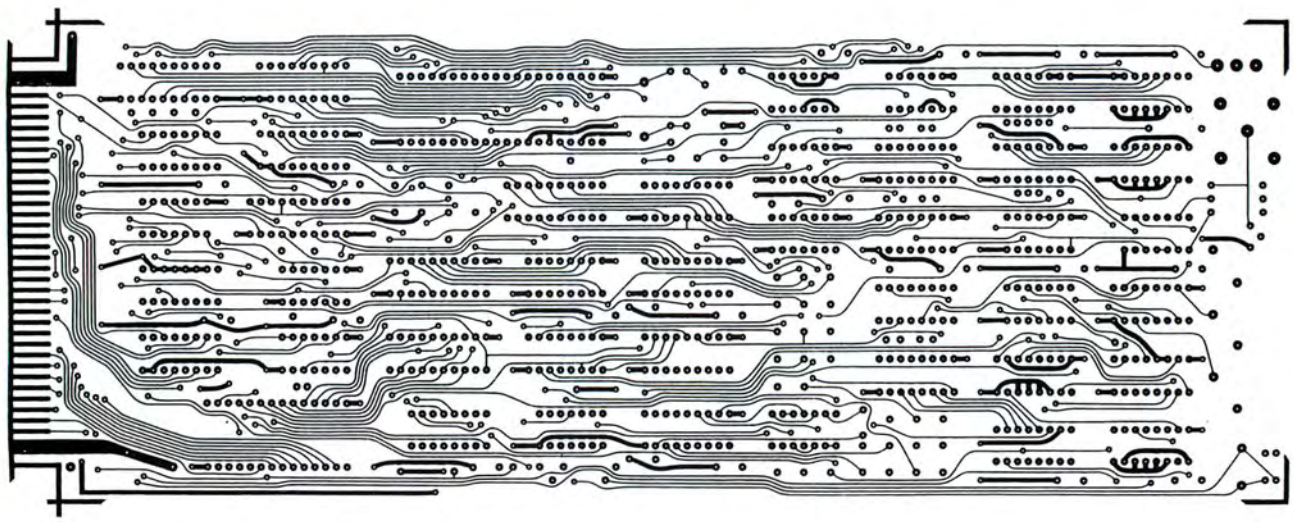


Figure 6.
(58.5% of Actual Size)

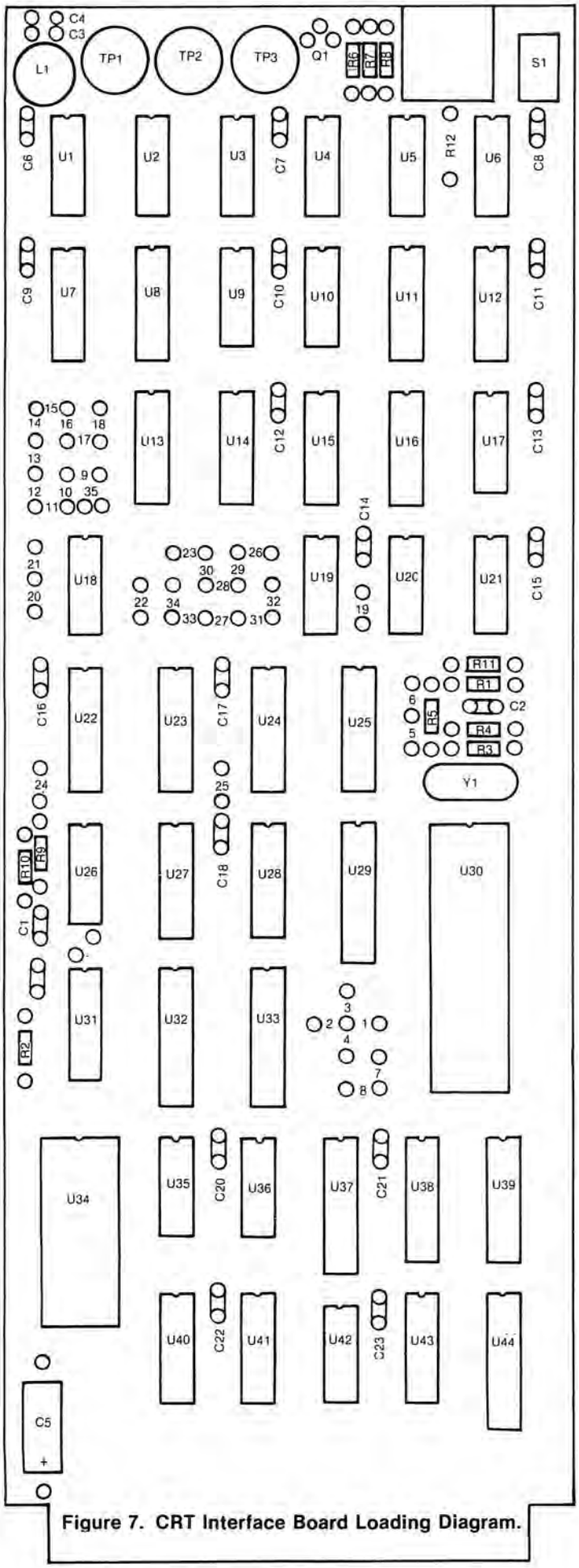


Figure 7. CRT Interface Board Loading Diagram.

The final part of the video card is the character generation circuitry (Figure 4). This circuitry consists of a set of four 256x4 MM2112 RAMs. These RAMs are wired in parallel for a total memory of 512 characters (16 lines of 32 characters each) in the present implementation. However, the PC board is set up so that these parts may be easily replaced by the 1Kx4 MM2114, thus quadrupling the capacity of the board.

The video RAMs hold an ASCII representation of the characters which are to be painted on the screen. In the normal mode of operation the control circuitry is generating a series of RAM addresses, the ASCII contents of which are sent to the character generator (U28). From the character generator (DM8678), a string of dots is sent into the video output circuit (U4). Here the video dot stream is mixed with horizontal and vertical synch to form a composite video signal. This signal is output through a Process 20 transistor as NTSC composite video.

The video interface PC board shown in Figures 5 (top artwork), 6 (bottom artwork), and 7 (loading diagram). A listing of the firmware for the card is given in Figure 8.

SUMMARY

The system described here was originally generated as an emulation of a new CRT controller chip, the DP3850. This chip, scheduled for availability in the first quarter of 1978, provides the dot clock, line counter, character counter, and all of the other functions presently supplied by the logic shown in Figure 3. In building up this board, we found uses for it in a variety of situations calling for low-cost display. Since it is software configurable, it can serve a wide variety of useful functions: replacing teletypes or other terminals, forming a small stand-alone computer system, or being used with a separate computer to provide the facility of an intelligent terminal.

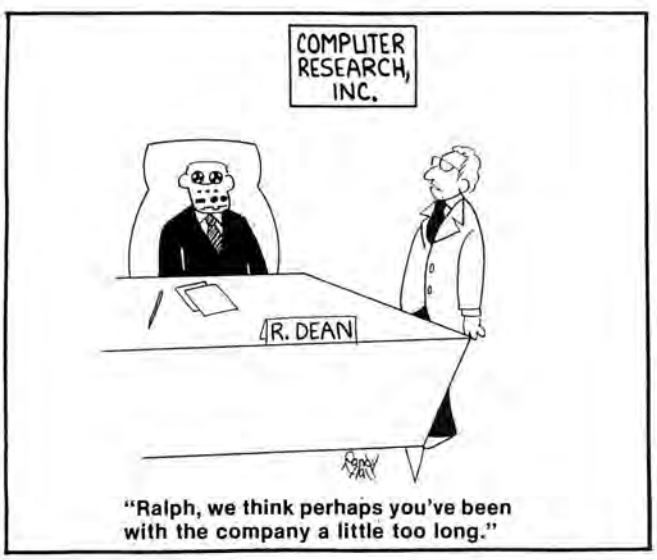
Figure 8. CRT Interface Card Firmware Listing

```
                        .TITLE  CRTDCA, ' CRT WITH DCA'
                        .LIST   ME
                ;       P1 = CURSOR LOCATION COUNTER
0011    HOME    =       X'11            ;CNTL-Q, X-ON OR DC 1
000D    CARET   =       X'0D
000C    RIGHT   =       X'0C            ;CNTL-L OR RIGHT ARROW
0008    LEFT    =       X'08            ;CNTL-H OR BACK ARROW
001B    UPP     =       X'1B            ;CNTL-K OR UP ARROW
000A    LNFD    =       X'0A            ;CNTL-J OR LINE FEED
001A    UEXTER  =       X'1A            ;END OF VIDEO BUFFER
0012    CLEAR   =       X'12            ;CNTL-R, TAPE OR DC 2
0013    DLINE   =       X'13            ;CNTL-S, X-OFF OR DC 3
0017    LEXTER  =       X'17            ;LOWER LIMIT OF BUFFER
001B    ESC     =       X'1B            ;ESCAPE CHARACTER
0001    P1      =       1
0002    P2      =       2
0003    P3      =       3
0004    F2      =       4               ;FLAG TO RESET INPUT LATCH
                ; ESCAPE SEQUENCE (DIRECT CURSOR ADDRESSING)
                ;  SEND ESC CHARATER FOLLOWED BY LINE NUMBER THEN CHAR. NUMBE
                ;  EXAMPLE:
                ;    PLACE CURSOR AT CENTER OF SCREEN
                ;    SEND ESC,X'8,X'10
                        .MACRO  RESET
                        CSA
                        ANI     %F2
                        CAS
                        ORI     F2
                        CAS
                        .ENDM
0000                    .=0
0000 00         INIT:   NOP
0001 C408               LDI     08              ;SET P1 TO POINT AT VIDEC RAM
0003 35                 XPAH    P1
0004 C400               LDI     0
0006 31                 XPAL    P1
0007 06                 CSA
0008 DC04               ORI     F2              ;SET FLAG 2
000A 07                 CAS
000B 35         SPACE:  XPAH    P1              ;CLEAR SCREEN TO SPACES
000C 01                 XAE
000D C40A               LDI     0A
000F 60                 XRE                     ;CHECK FOR END OF BUFFER
0010 980A               JZ      SCURS           ;DONE, SET CURSOR
0012 40                 LDE
0013 35                 XPAH    P1
0014 C420               LDI     020
0016 CD01               ST      #1(P1)
0018 90F1               JMP     SPACE
001A C400       SCURS:  LDI     0               ;RESET VIDEO RAM POINTER
001C 31                 XPAL    P1
001D C408               LDI     08
001F 35                 XPAH    P1
0020 C180               LD      (P1)
0022 DC80               ORI     080             ;"OR" IN CURSOR BIT
0024 C900               ST      (P1)
0026 06         GECO:   CSA
0027 D410               ANI     010             ;CHECK SENSE A LINE
0029 98FB               JZ      GECO
002B C49C               LDI     9C              ;POINT P2 AT INPUT LATCH
002D 36                 XPAH    P2
002E C400               LDI     0
0030 32                 XPAL    P2
0031 C200               LD      (P2)            ;INPUT CHARACTER
0033 01                 XAE
0034                    RESET                   ;RESET INPUT LATCH
0034 06                 CSA
0035 D4FB               ANI     %F2
0037 07                 CAS
0038 DC04               ORI     F2
003A 07                 CAS
003B 40                 LDE
003C E411               XRI     HOME            ;CHECK FOR HOME CHARACTER
003E 982B               JZ      HHOME
0040 40                 LDE
0041 E40D               XRI     CARET           ;CHECK FOR CARRIAGE RETURN
0043 983A               JZ      XCARET
0045 40                 LDE
0046 E40C               XRI     RIGHT           ;CHECK FOR "CURSOR RIGHT"
0048 9858               JZ      XRIGHT
004A 40                 LDE
004B E40A               XRI     LNFD            ;CHECK FOR "LINE FEED"
004D 9873               JZ      XLNFD
004F 40                 LDE
0050 E40B               XRI     UPP             ;CHECK FOR "CURSOR UP"
0052 986A               JZ      IXUPP
0054 40                 LDE
0055 E408               XRI     LEFT            ;CHECK FOR "CURSOR LEFT"
0057 9865               JZ      IXLEFT
0059 40                 LDE
005A E412               XRI     CLEAR           ;CHECK FOR CLEAR SCREEN
005C 98A3               JZ      INIT
005E 40                 LDE
005F E413               XRI     DLINE           ;CHECK FOR DELETE LINE
0061 9872               JZ      DELINE
0063 43                 LDE
0064 E41B               XRI     ESC             ;CHECK FOR ESCAPE SEQUENCE
0066 986B               JZ      IXESC           ; DIRECT CURSOR ADDR.
0068 40                 LDE
0069 993C               JMP     XRIGHT+2
006B C180       HHOME:  LD      (P1)            ;HOME CURSOR
006D D47F               ANI     07F
006F C900               ST      (P1)
0071 C400               LDI     0
0073 31                 XPAL    P1
0074 C408               LDI     08
0076 35                 XPAH    P1
0077 C180               LD      (P1)
0079 DC80               ORI     080             ;PUT CURSOR AT FIRST CHARACTE
007B C900               ST      (P1)            ; ON SCREEN
007D 98A7               JMP     GECO
007F C180       XCARET: LD      (P1)            ;REMOVE CURSOR FROM CURREN
0081 D47F               ANI     07F             ; POSITION
0083 C900               ST      (P1)
0085 31                 XPAL    P1
0086 D480       2       ANI     080             ;PLACE POINTER AT FIRST
0088 31                 XPAL    P1              ; POSITION OF CURRENT LINE
0089 C180               LD      (P1)            ;GET CHARACTER
008B DC80               ORI     080             ;ADD CURSOR BIT
008D C900               ST      (P1)
008F 9095       IXGECO: JMP     GECO
0091 C409       LSTLNE: LDI     09
0093 37                 XPAH    P3
0094 C480               LDI     080
0096 33                 XPAL    P3
0097 C408               LDI     08
0099 35                 XPAH    P1
009A C400               LDI     0
009C 31                 XPAL    P1
009D C408               LDI     08
009F 36                 XPAH    P2
00A0 C420               LDI     020
00A2 32                 XPAL    P2
00A3 904D               JMP     GO
00A5 C180       XRIGHT: LD      (P1)            ;REMOVE CURRENT CURSOR
00A7 D47F               ANI     07F
00A9 CD01               ST      #1(P1)          ;RESTORE AND BUMP POINTER
00AB 35                 XPAH    P1
00AC 01                 XAE
00AD 40                 LDE
00AE E40A               XRI     UEXTER          ;CHECK FOR END OF BUFFER
00B0 98DF               JZ      LSTLNE
00B2 40                 LDE
00B3 35                 XPAH    P1
00B4 C180               LD      (P1)
00B6 DC80               ORI     080             ;PLACE CURSOR AT NEW POSITION
00B8 C900               ST      (P1)
00BA 90D3               JMP     IXGECO
00BC 9067       IXUPP:  JMP     XUPP
00BE 9045       IXLEFT: JMP     IZLEFT
00C0 90AF       IXHOME: JMP     HHOME+6
00C2 C180       XLNFD:  LD      (P1)            ;REMOVE CURRENT CURSOR
00C4 D47F               ANI     07F
00C6 CD20               ST      #32(P1)         ;BUMP POINTER TO NEXT LINE
00C8 35                 XPAH    P1
00C9 01                 XAE
00CA 40                 LDE
00CB E40A               XRI     UEXTER          ;CHECK FOR END OF BUFFER
00CD 98C2               JZ      LSTLNE          ;END OF BUFFER, ROLL SCREEN
00CF 40                 LDE
00D0 35                 XPAH    P1
00D1 90A4               JMP     HHOME+12        ;PUT CURSOR AT NEXT LINE
00D3 9046       IXESC:  JMP     ZXESC
00D5 31         DELINE: XPAL    P1
00D6 D4E0               ANI     0E0
00D8 01                 XAE
00D9 40                 LDE
00DA 31                 XPAL    P1
00DB 40                 LDE
00DC 32                 XPAL    P2
00DD 40                 LDE
00DE 33                 XPAL    P3
00DF 35                 XPAH    P1
00E0 01                 XAE
00E1 40                 LDE
00E2 35                 XPAH    P1
00E3 40                 LDE
00E4 36                 XPAH    P2
00E5 40                 LDE
00E6 37                 XPAH    P3
00E7 C620               LD      #32(P2)
00E9 36                 XPAH    P2
00EA 01                 XAE
00EB 40                 LDE
00EC E40A               XRI     UEXTER
00EE 98DA               JZ      RSPACE
00F0 40                 LDE
00F1 36                 XPAH    P2
00F2 C681       GO:     LD      #1(P2)
00F4 CD01               ST      #1(P1)
00F6 36                 XPAH    P2
00F7 01                 XAE
00F8 40                 LDE
00F9 E40A               XRI     UEXTER
00FB 98DA               JZ      RSPACE
00FD 40                 LDE
00FE 36                 XPAH    P2
00FF 90F1               JMP     GO
0101 908C       IGECO:  JMP     IXGECO
0103 90BB       ZHOME:  JMP     IXHOME
0105 903E       IZLEFT: JMP     XLEFT
0107 C420       RSPACE: LDI     020
0109 01                 XAE
010A 40                 LDE
010B CD01               ST      #1(P1)
010D 01                 XAE
010E 02                 CCL
010F F4FF               ADI     -1
0111 9803               JZ      .+5
0113 01                 XAE
0114 90F5               JMP     RSPACE+4
0116 C380               LD      (P3)
0118 DC80               ORI     080
011A CB80               ST      (P3)
011C 33                 XPAL    P3
011D 31                 XPAL    P1
011E 37                 XPAH    P3
011F 35                 XPAH    P1
0120 02                 CCL
0121 90DE               JMP     IGECO
0123 9037       ZXESC:  JMP     XESC
0125 C180       XUPP:   LD      (P1)
0127 D47F               ANI     07F
0129 C900               ST      (P1)
012B C5E0               LD      #-32(P1)
012D 35                 XPAH    P1
012E 01                 XAE
012F 40                 LDE
0130 E407               XRI     LEXTER
0132 9808               JZ      XAA
0134 40                 LDE
0135 35                 XPAH    P1
0136 DC80       XBB:    ORI     080
0138 C900               ST      (P1)
013A 90C5               JMP     IGECO
013C 40         XAA:    LDE
013D 02                 CCL
013E F402               ADI     2
0140 35                 XPAH    P1
0141 C180               LD      (P1)
0143 90F1               JMP     XBB
0145 C180       XLEFT:  LD      (P1)            ;REMOVE CURRENT CURSOR
0147 D47F               ANI     07F
0149 C900               ST      (P1)
014B C5FF               LD      #-1(P1)         ;DECREMENT POINTER
014D 35                 XPAH    P1
014E 01                 XAE
014F 40                 LDE
0150 E407               XRI     LEXTER          ;CHECK IF BELOW BUFFER
```

```
282 0152 98AF            JZ      ZHOME
283 0154 40              LDE
284 0155 35              XPAH    P1
285 0156 DC80            ORI     080             ;PLACE CURSOR AT NEW POSITION
286 0158 C900            ST      (P1)
287                 RETGCO:
288 015A 90A5            JMP     IGECO
289                 XESC:
290 015C 06              CSA                     ;WAIT FOR NEXT CHARACTER
291 015D D410            ANI     010             ;CHECK SENSE A LINE
292 015F 98FB            JZ      XESC
293 0161 C280            LD      (P2)            ;GET LINE NUMBER (1-16)
294 0163 01              XAE
295 0164                 RESET                   ;RESET INPUT LATCH
    0164 06              CSA
    0165 D4FB            ANI     %F2
    0167 07              CAS
    0168 DC04            ORI     F2
    016A 07              CAS
296 016B 40              LDE
297 016C 02              CCL
298 016D F4EF            ADI     -17             ;CHECK IF IN RANGE
299 016F 9402            JP      ERR1            ;RANGE ERROR IF POS.
300 0171 9810            JMP     NUMOK           ;IN RANGE
301                 ERR1:
302 0173 06              CSA                     ;WAIT FOR SECOND CHAR. TO
303 0174 D410            ANI     010             ; FINISH SEQUENCE.
304 0176 98FB            JZ      ERR1
305 0178 C280            LD      (P2)            ;CLEAR INPUT LATCH
306 017A                 RESET                   ;RESET INPUT LATCH
    017A 06              CSA
    017B D4FB            ANI     %F2
    017D 07              CAS
    017E DC04            ORI     F2
    0180 07              CAS
307 0181 9007            JMP     RETGCO          ;ERROR, WAIT FOR NEXT CHAR.
308                 NUMOK:
309 0183 C180            LD      (P1)            ;REMOVE CURSOR
310 0185 D47F            ANI     07F
311 0187 C980            ST      (P1)
312 0189 40              LDE
313 018A 02              CCL                     ;CLEAR LINE POV ROTATE
314 018B 1F              RRL                     ;MULTIPLY BY 16
315 018C 1F              RRL
316 018D 1F              RRL
317 018E 1F              RRL
318 018F 01              XAE
319 0190 06              CSA
320 0191 D480            ANI     080             ;CHECK FOR LINK
321 0193 9805            JZ      NLINK           ;NO LINK
322 0195 C489            LDI     89              ;IN SECOND HALF OF BUFFER
323 0197 35              XPAH    P1
324 0198 9003            JMP     LINK
325                 NLINK:
326 019A C488            LDI     88
327 019C 35              XPAH    P1
328                 LINK:
329 019D 01              XAE                     ;SET LINE NUMBER
330 019E 31              XPAL    P1
331 019F 06              CSA                     ;WAIT FOR SECOND CHAR.
332 01A0 D410            ANI     010             ;CHECK SENSE A LINE FOR INPUT
333 01A2 98FB            JZ      WAIT2
334 01A4 C280            LD      (P2)
335 01A6 01              XAE
336 01A7                 RESET                   ;PULSE FLAG 2 TO RESET LATCH
    01A7 06              CSA
    01A8 D4FB            ANI     %F2
    01AA 07              CAS
    01AB DC04            ORI     F2
    01AD 07              CAS
337 01AE 40              LDE
338 01AF 02              CCL
339 01B0 F4DF            ADI     -33             ;CHECK IF IN RANGE
340 01B2 94A6            JP      RETGCO          ;SECOND NUMBER INVALID IF POS
341                 SNUMOK:
342 01B4 02              CCL
343 01B5 31              XPAL    P1
344 01B6 D4E0            ANI     0E0             ;MASK CHARACTER COUNT
345 01B8 70              ADE
346 01B9 31              XPAL    P1              ;SET CURSOR AT NEW LOCATION
347 01BA C180            LD      (P1)
348 01BC DC80            ORI     080             ;PLACE CURSOR AT NEW POSITION
349 01BE C980            ST      (P1)
350 01C0 9008            JMP     RETGCO
351
352       0000           .END

CARET  0070   CLEAR  0012   DELINE 00D5   DLINE  0013
ERR1   0173   ESC    001B   F2     0004   GECO   0026
GO     00F2   HMOME  0068   HOME   0011   IGECO  0101
INIT   0001   IXESC  00D3   IXGECO 00AF   IXHOME 0060
IXLEFT 0088   IXUPP  0080   IZLEFT 0105   LEFT   0048
LEXTER 0007   LINK   0190   LNFD   00AA   LSTLNE 0091
NLINK  019A   NUMOK  0183   P1     0001   P2     0002
P3     0003   RETGCO 015A   RIGHT  0040   RSPACE 0127
SCURS  001A   SNUMOK 01B4 *  SPACE  0020   UEXTER 00DA
UPP    0008   WAIT2  019F   XAA    013C   XBR    0136
XCARET 007F   XESC   015C   XLEFT  0145   XLNFD  00C2
XRIGHT 00A5   XUPP   0125   ZHOME  0103   ZXESC  0123

NO ERROR LINES
SOURCE CHECKSUM = 495A
INPUT FILE    2:CRTDCA.SRC ON #28  GRN
```



"Ralph, we think perhaps you've been with the company a little too long."

Interval Timer Design

By Darrel J. Van Buer

INTRODUCTION

The element of time is a powerful feature in the computer environment. With it, the computer can take actions based on how long an event takes and also accurately control when events happen. The computer can do simple tasks such as turn lights on and off at preplanned times or act as a stopwatch. Timing can also be used to make games more challenging by forcing play into real time. In a computer dedicated to a single job, it may be possible to do any needed timing with carefully-planned program loops. In complex applications, however, it is extremely difficult to do this, making some kind of hardware clock desirable, if not essential.

DESIGN GOALS

Once I decided I should have a hardware clock, I listed my requirements for it. They are:

1) Clock operation should use little computing power.
2) The clock should have high resolution. For my purposes I wanted millisecond resolution.
3) Its accuracy should not depend on when the computer looks at it. For example, with a digital watch using a 4-digit display, it may be read inconsistently as follows. Read the hours and minutes (say 10:23), then read the seconds. If the seconds show 00, the time may be 10:23:00 or 10:24:00 depending on when the second changes versus the display change.
4) Its accuracy should not be disturbed by setting operations. This is related to the previous item.
5) The clock should be low in direct hardware costs for itself) and indirect hardware costs for memory or other boards.

I am aware of three clocks currently available for the hobbyist standard bus but none of them meets my criteria. Two of them require a vectored interrupt card. The other has only one second resolution. The remainder of this article is devoted to my own design for a clock.

LOGIC CIRCUIT

The logic circuit I built is actually an interval timer rather than a true clock. (Figure 1) The section on programs contains the software to simulate a clock with this timer. There are four parts to the interval timer I built. The CPU sees two parts, an 8-bit I/O port which is also a counter, and a 2-bit output port which regulates timer interrupts. The third part of the circuit is a chain of counters to derive circuit timing from CPU timing. The fourth part consists of logic to detect and correct situations which can lead to timekeeping errors.

The counter port is central to the operation of the timer. It is an 8-bit counter which counts down one step each millisecond. The counter is treated as a signed number which ranges from +127 to −128. When the counter is negative, it causes an interrupt. Normal use of the timer consists of outputting a positive number to the counter and waiting for the interrupt to occur when the interval expires.

This circuit, together with the support programs which follow, meet my design goals. When timing is not being actively used, the CPU spends less than one percent of the time maintaining time of day since interrupts can occur 128 milliseconds apart. Further, since the timer can record properly unserviced interrupts for another 127 milliseconds, correct operation is less demanding than Teletype interrupts. Anomalies in setting and reading the timer are avoided because the entire timer is a single port. Costs are low because the circuit contains only nineteen TTL IC's and the software to support the clock takes less than 400 bytes.

The accuracy of a clock should not depend on when the computer looks at it, nor should it be disturbed by setting operations.

Most of the circuit is straightforward. IC H and IC I, together with ICs F, G, J and K form the counter and I/O port. The gates in IC A, IC B, IC C and IC D decode the various I/O signals honored by the circuit. IC O and IC P form the main part fo the divider chain which derives millisecond clocking from the CPU 01 clock. IC N, a dual multivibrator, is used to generate short, square clock pulses about 40 nanoseconds duration to clock the I/O counter cleanly.

One half of IC Q halves the 2 MHz system clock frequency while the other half resynchronizes the divider chain output to the falling edge of the 01 clock, permitting less expensive ripple counters in the chain. Figure 2 shows this timing.

Half of IC R and all of IC S are used to detect potentially missing clock pulses and restore them if necessary. Without these flip-flops, this sequence of events would lose one clock pulse: CPU inputs from counter; counter gets clocked by divider chain; CPU outputs a new value to the counter. As a result, one clock pulse is too late to be seen by the CPU during the input and then is obliterated by the CPU output.

Figure 3 shows the timing for these flip-flops when the CPU reads the timer. Since both the counter and the CPU DBIN signal are synchronized to the falling edge of

the 01 clock, any clock pulses which occur before the end of an input instruction will be reflected in the count read by the CPU. IC R pin 3 serves to generate a delayed indication of the start of the DBIN pulse and is used to reset both halves of IC S. IC S pin 2 is high whenever the clock is in a perilous situation, that is, whenever a clock pulse could be lost. The other half of IC S is clocked when the counter is clocked and latches the current value of the perilous flip-flop. IC S pin 5 thus goes high any time input is followed by a clock pulse. A subsequent reading of the clock by the CPU resets this flag since the CPU again has the true value of the timer.

Figure 4 shows what happens when a write to the counter occurs. The trailing edge of the $\overline{WR}$ signal from the CPU resets the perilous condition. If the missed flag was set, the next time the 02 clock rises, the output of the AND gate (IC C pin 12) goes high and triggers the single shot (IC N). This sends an extra clock pulse to the counter to replace the one missed.

The only software restriction posed by this scheme is that any read followed write to update the timer occurs not more than one clock pulse apart since only one missed pulse can be handled.

One of the spare sections of the three state bus drivers used for the counter output is wired to simulate an open collector pulldown which should be *jumpered* to an active low interrupt line. Since the counter may be read to determine if it is the source of an interrupt, it can share an interrupt line with other devices which are polled when the interrupt occurs.

The address selection circuitry is set to decode 253 and 254 (decimal) input/output instructions. The counter is selected for input/output by address 253 while the interrupt control port is selected by output to address 254. These addresses are used to provide compatibility with the ports assigned to vectored interrupt and realtime clock circuits supplied by various microcomputer manufacturers.

Timer interrupts may be selectively enabled and disabled by outputting suitable values to port 254. Only the values of bits 4 and 5 are used by this circuit. The other bits are reserved for controlling a vectored interrupt circuit which might be in the system. The interrupt status of the clock is set whenever bit 4 of the output byte is high. If bit 5 is also high, interrupts will be enabled; otherwise interrupts will be disabled. Note that bit 7 is the most significant bit in the 8080A type.

The prototype of the circuit was built on a standard wire wrap board which fits the hobby standard bus at a total cost of about fifty dollars. Because of the small size of the circuit, most of the board is left free for other uses. This circuit is carefully synchronized to the system timing eliminating the need for any adjustments. There is no speed problem associated with this circuit so that the ICs used may be drawn from any TTL subfamily to minimize cost or power consumption.

The timekeeping accuracy is as good as the accuracy of the crystal driving the CPU clock generator. Without adjustment, this will typically give accuracy to better than one minute per day. For more critical needs, a small trimmer capacitor can be wired in series with the crystal and used to tune the frequency more accurately. Careful tuning can yield accuracy of a minute per year.

TIMEKEEPING PROGRAMS

All of these programs assume the divider chain jumper has been set for millisecond resolution. Other jumper settings will require some changes in the details of these programs, but the major structure would not change.

Program 1 is a short program which can be used to check the circuit for correct timer operation. The first few lines initialize a serial output port. These should be changed to fit the equipment in a system. The remainder of the program loops, setting the testing the timer. If the timer is functioning correctly, an 'X' is printed at the terminal every thirty seconds. Further, the timing accuracy should be unaffected by the choice of TEST1 and TEST2 as the jump destination. If the two versions run at different rates, there are problems in the missed clock pulse circuitry. If both versions are inaccurate, the problem most likely lies either in the divider chain or the CPU clock generator. If it fails to run at all, check the port selection circuitry.

The remaining programs are a set of routines designed to provide most of the timing support in a system. the times of day in the system are stored as 4-byte values broken up as hours, minutes and milliseconds as shown in Figure 5. The current time of day is defined to be the time of expiration (in TOX) less the time in the interval timer. This means that the timer will generate an interrupt immediately following the stored time of expiration. The computation of the current time is carried out by Program 2.

With this circuit, an 8080 microprocessor can keep accurate time for long periods with high resolution and simultaneous multiple timing of several events.

Program 3 is the subroutine used to request that an action be performed at some future time. When STIMER (Program 3) is called, HL should point to a timer queue element, the format of which is shown in Figure 5. The action part is a 2-byte value which will be passed to an application dependent on routine called DONOW in the listings. DONOW is not supplied, but it should take some simple action such as setting a flag or outputting data to some device. The DONOW routine is called once the time given in the requested time of expiration has been reached. Using the link field, STIMER keeps all the unexpired requests in a linked list ordered according to time. Because the calls are recorded in a list, STIMER may be called any number of times to schedule a great many future events, so long as each call provides a separate TQE. The program also can handle times which are already past.

Program 4 is the timer interrupt handler routine which maintains the time of expiration (TOX) and timer value and determines when any events scheduled by calls to STIMER should occur. Because the timer can count down from at most 127 each time its value is set, the interrupt handler essentially must break up long periods of time into numerous short intervals. All of these short intervals are 127 milliseconds except when one of the STIMER events is scheduled sooner. This routine also implies two more restrictions on the DONOW routine: it must run with interrupts disabled and it must finish within 127 milliseconds after being called (before the clock underflows).

SUMMARY

This article presents an inexpensive circuit together with software which enables an 8080 microprocessor to keep accurate time over long periods of time. Furthermore, time is kept to high resolution and any number of events can be timed simultaneously. Properly integrated into a system, virtually all timing requirements can be met in a wide variety of applications.

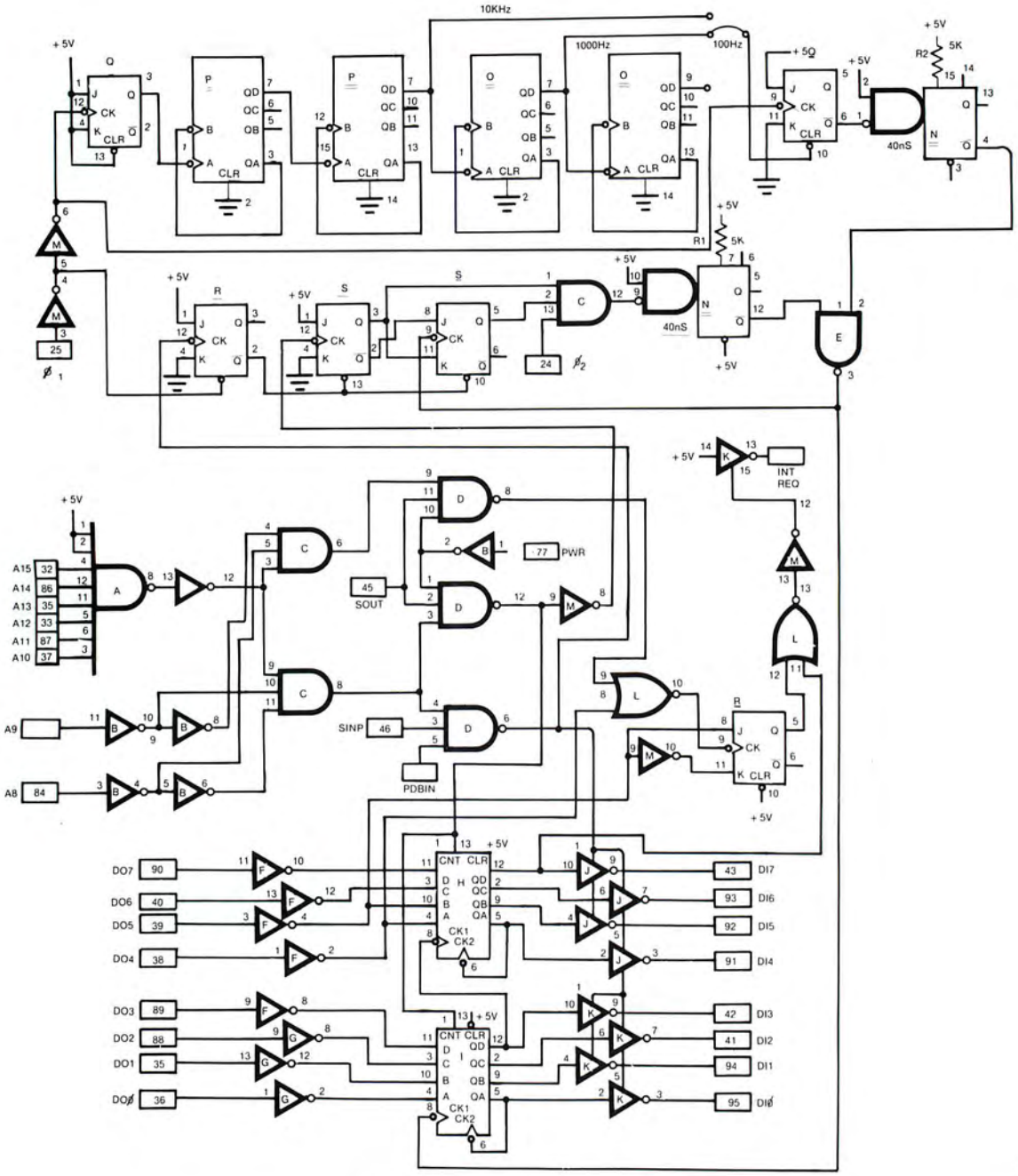


Figure 1. Interval Timer Logic Diagram

PARTS LIST

R1, R2 — 5000 ohms, ¼-watt
ICA — 74L30
ICB, ICF, ICG, ICM — 74L04 hex inverter
ICC — 7411 triple three input and
ICD — 7410 triple three input nand
ICE — 7400 quad nand
ICH, ICI — 74177 binary counter
ICJ, ICK — 74368 inverting bus driver
ICL — 7402 quad nor
ICN — 74123 dual monostable
ICO, ICP — 74390 dual decimal counter
ICQ, ICR, ICS — 74107 dual flip-flop

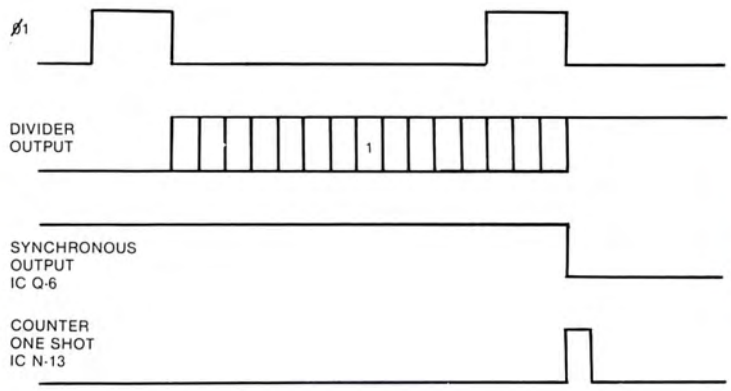


Figure 2. Timer Clocking
NOTES 1 Signal may change any time in this interval.

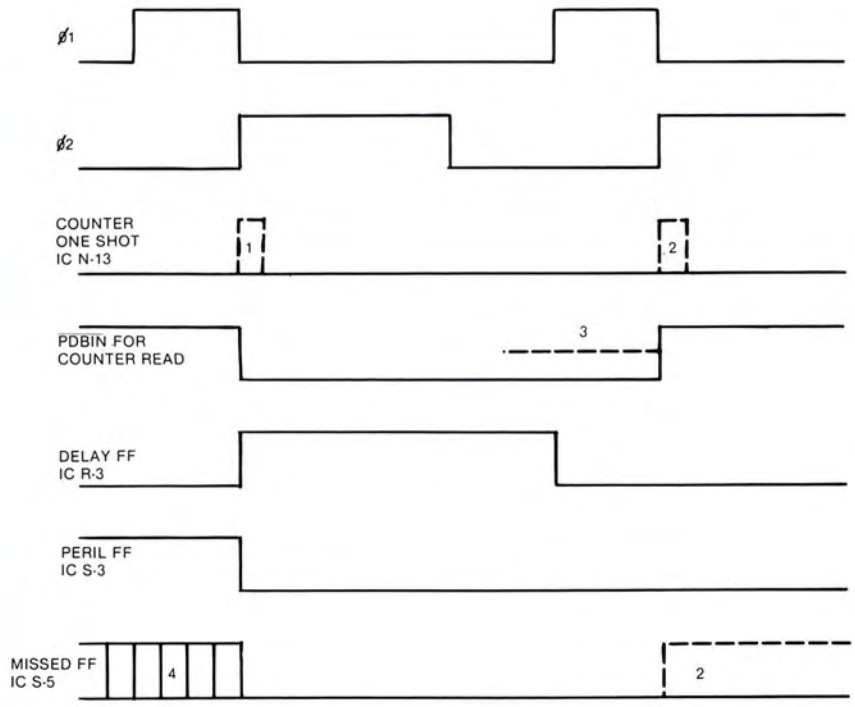


Figure 3. Read Timing
NOTES
1 A count here will be reflected in timing value read.
2 A count here (or later) sets the missed flag.
3 This is the approximate time the 8080 processor expects valid data.
4 The missed condition may exist at this time.

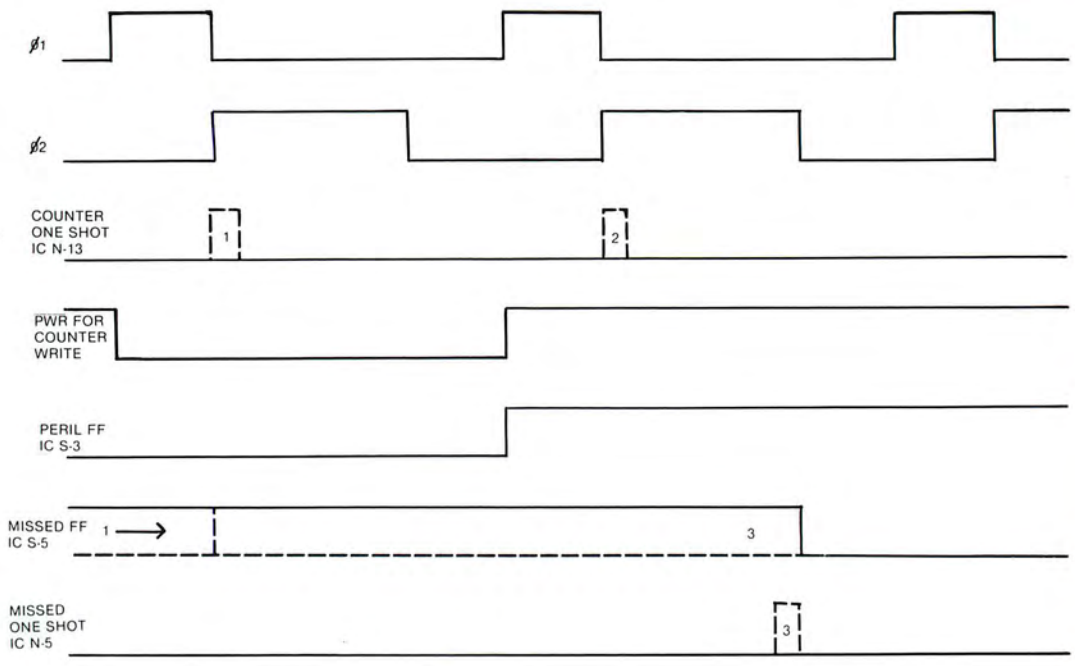
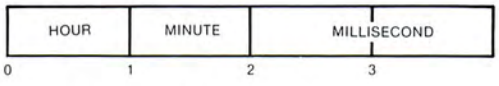


Figure 4. Write Timing

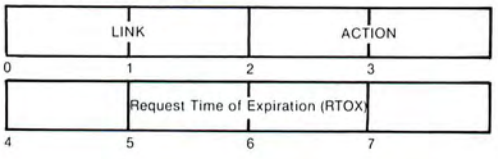
NOTES
1. If a count occurs here, the missed flag will be set. The counter will not be clocked due to load mode.
2. A count here normally advances the timer.
3. Pulse generated only if missed flag set at this time.

Time Format



HOUR is an 8-bit unsigned integer from 0 to 255.
MINUTE is an 8-bit integer from 0 to 59.
MILLISECOND is a 16-bit unsigned integer from 0 to 59999.

Timer Queue Element (TQE)



LINK is a two byte area reserved for use by STIMER
ACTION is a two byte value to passed to DONOW
ROX is a time of day as shown above. DONOW is called at the first opportunity following this time.

Figure 5. Data Formats for Programs

```
LABEL   OP    OPERANDS          COMMENTS
        MVI   A,3               INITIALIZE TERMINAL
        OUT   2
        MVI   A,0A9H
        OUT   2
UP      MVI   B,240             8*30. SET TOTAL TIME
        MVI   A,C'X'            SIGNAL 30 SECOND MARKER
        OUT   3                 PRINT 'X' ON TERMINAL
TL      MVI   A,125             125 MILLISECONDS
TEST1   OUT   253               OUTPUT TO INTERVAL TIMER
TEST2   IN    253               READ INTERVAL TIMER
        ANA   A                 HAS TIME RUN OUT
        JNZ   TEST1 or TEST2    LOOP TILL TIMER IS ZERO
        DCR   B                 COUNT ONE OF 240 EIGHTH SECONDS
        JNZ   TL                LOOP TILL 30 SECONDS
        JMP   UP                GO PRINT AN X
```

See test for use of TEST1 and TEST2.

Program 1. Hardware Checkout Program.

```
LABEL   OP    OPERANDS          COMMENTS
TOD     PUSH  PSW               SAVE REGISTERS THROUGH SUBROUTINE
        PUSH  H
        PUSH  D
        LXI   D, CVTTOX         PREPARE TO COPY FROM MASTER CLOCK
        DI                      DO NOT DISTURB
        LDAX  D                 COPY TO AREA PROVIDED IN (HL)
        MOV   M,A               HOURS
        INX   H
        INX   D
        LDAX  D
        MOV   M,A               MINUTES
        INX   H
        INX   D
        LDAX  D
        MOV   M,A               HIGH BYTE OF MILLISECONDS
        INX   H
        INX   D
        LDAX  D
        MOV   M,A               LOW BYTE OF MILLISECONDS
        IN    253               CURRENT TIMER VALUE
        EI                      NOW HAVE CONSISTENT CLOCK DATA
        POP   D                 RESTORE REGISTER
        CALL  SBAFRT            SUBTRACT TIMER VALUE FROM MASTER
```

```
        POP     H       CLOCK VALUE GIVING CURRENT TIME
        POP     PSW     AND RESTORE REGISTERS
        RET
```

Calling convention for TOD is that HL contains the address of a four byte area in memory into which time will be placed. See Figure 4 for the format of these bytes.

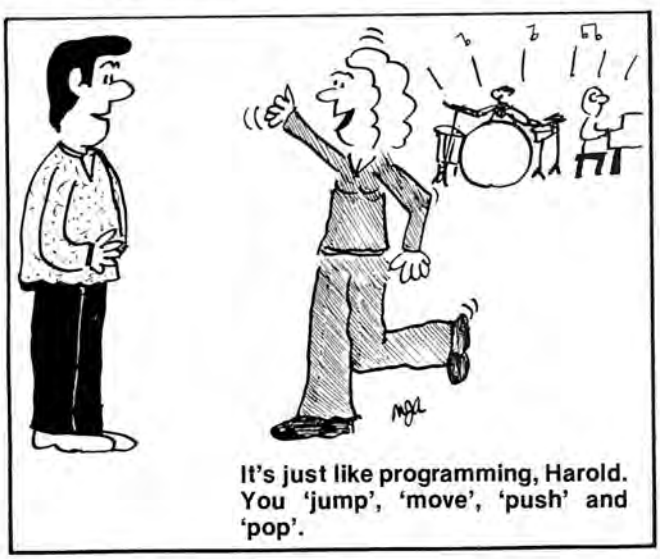
Program 2. Time of Day Subroutine.

```
LABEL   OP      OPERANDS        COMMENTS
STIMER  PUSH    D               SAVE REGISTERS THROUGH SUBROUTINE
        PUSH    B
        PUSH    PSW
        PUSH    H               SAVE POINTER TO TIMER REQUEST DATA
        LXI     D,4             OFFSET TO RTOX IN REQUEST
        DAD     D               HL AT RTOX
        LXI     D,CVTTOX        COMPARE TO TOX FOR TIMER
        XCHG
        DI                      DO NOT DISTURB
        CALL    COMPTOX         COMPARE THE TWO TIMES
        JNC     ENQTOX          JUMP IF REQUEST AFTER CURRENT TIMER
        POP     H               RESTORE HL VALUE
        PUSH    H               BUT STILL SAVE IT
        LXI     D,7             OFFSET TO LAST BYTE OF RTOX
        DAD     D
        LXI     D,CVTTOX+3      LAST BYTE OF CVTTOX
        CALL    FIGCLK          NOT OVER 127 BEFORE CVTTOX?
        POP     H               IF NOT, NEVER RETURNS
        PUSH    H               RESTORE AND SAVE REQUEST POINTER
        INX     H               TIME ALREADY PAST, SO CALL DONOW
        INX     H               GET DATA FOR DONOW FROM REQUEST
        MOV     E,M
        INX     H
        MOV     D,M
        XCHG                    PUT PARM IN HL
        CALL    DONOW           PERFORM TIMER EXPIRATION ACTION
        EI                      DONE
        POP     H               RESTORE REGISTERS
        JMP     STIMXIT         GO RETURN
FIGCLK  CALL    DIF127          IF TIMES ARE OVER 127 MS APART, RETURN
        RET                     RETURN IF FAR APART. DIF127 SKIPS 2
        NOP                     BYTES IF 127 OR LESS (TO NEXT LINE)
        POP     H               DISCARD RETURN ADDRESS IN STACK
        IN      253             SHORTEN THE CURRENT TIMER EXPIRATION
        SUB     B               BY THE RESULT OF DIF127 (IN B)
        OUT     253             UPDATE TIMER
        MOV     A,B             SIMILARLY DECREASE CVTTOX
        LXI     H,CVTTOX+3      ADDRESS OF LAST BYTE OF CVTTOX
        CALL    SUBAB           GO SUBTRACT
ENQTOX  POP     D               ADD NEW TQE TO CHAIN IN TOX ORDER
        LXI     H,CVTTQE        HL AT TQE CHAIN, DE AT NEW TQE
TESTFIT PUSH    D               SAVE NEW TQE LOCATION
        MOV     C,M             GET NEXT TQE FROM M(HL)
        INX     H
        MOV     B,M
        PUSH    H               SAVE LOCATION OF PREV TQE+1
        PUSH    B               SAVE LOCATION OF FOLLOWING TQE
        MOV     A,B             TEST FOR END OF CHAIN (ZERO POINTER)
        ORA     C
        JZ      INNOW           JUMP IF NEW RTOX AFTER ALL CURRENTLY ON
        LXI     H,4             RTOX OFFSET WITHIN TQE
        DAD     B               RTOX ADDRESS IN FOLLOWING TQE
        INX     D
        INX     D
        INX     D
        INX     D               DE IS RTOX ADDRESS IN NEW TQE
        XCHG
        CALL    COMPTOX         SEE IF NEW TIME IS BEFORE FOLLOWING
        JNC     INNOW           IS BEFORE, GO INSERT HERE
        POP     H               RECOVER LINK TO FOLLOWING TQE
        POP     D               DISCARD POINTER TO PREVIOUS TQE
        POP     D               NEW TQE POINTER AGAIN
        JMP     TESTFIT         AND REPEAT TESTS ONE DOWN THE LIST
INNOW   POP     B               PUT HERE IN CHAIN. BC TO FOLLOWING TQE
        POP     H               HL TO PREVIOUS TQE+1
        POP     D               NEW TQE
        MOV     M,D             MAKE PREVIOUS TQE POINT TO NEW TQE
        DCX     H
        MOV     M,E
        XCHG                    THEN MAKE NEW TQE POINT TO FOLLOWING
        MOV     M,C             TQE.
        INX     H
        MOV     M,B
        EI                      CRITICAL SECTION ENDED
        DCX     H               RESTORE HL TO BE TQE POINTER
STIMXIT POP     PSW             RESTORE OTHER REGISTERS
        POP     B
        POP     D
        RET                     BACK TO CALLER WITH EVENT SCHEDULED.
```

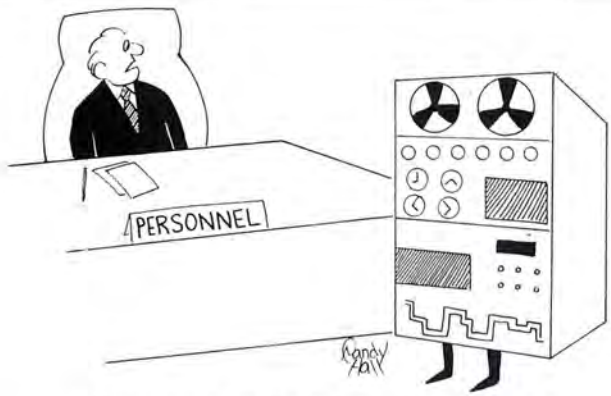
Program 3. Request Timing Routine.

```
LABEL     OP      OPERANDS      COMMENTS
; THE FIRST 8 BYTES GO IN LOW MEMORY LOCATION 8*n ACCORDING TO
; THE INTERRUPT LEVEL INCLUDING THE CLOCK. n IS 7 IF NO VECTORED
; INTERRUPTS. IN EITHER CASE, OTHER DEVICES MAY SHARE THE LEVEL.
RSTn      DI                    PROTECT AGAINST PROGRAM CALL/RST
          PUSH    H             SAVE WORKING REGISTERS
          PUSH    PSW
          IN      253           READ TIMER
          JMP     RSTXn         GO TO REMAINDER OF ROUTINE
; THE REMAINDER OF THIS ROUTINE MAY BE ANYWHERE IN MEMORY
RSTXn     ANA     A             TEST SIGN BIT FROM TIMER
          JP      NOCLK         NOT INTERRUPT SOURCE IF PLUS
          PUSH    B             SAVE REMAINING REGISTERS
          PUSH    D
FIG       IN      253           GET CURRENT TIMER VALUE
          LXI     H,CVTTOX+3    LAST BYTE OF CVTTOX
          CALL    SBAFRT        SUBTRACT TIMER FROM CURRENT TOX
          XRA     A             SET A TO ZERO
          OUT     253           ZERO TIMER SINCE VALUE COMBINED
          LHLD    CVTTQE        GET TQE LIST START
          MOV     A,L           SEE IF ANY TQE'S ON LIST
          ORA     H
          JZ      SET127        IF NOT, GO EXTEND TIMER 127 MS
          LXI     D,4           COMPARE RTOX IN TQE WITH CVTTQE
          DAD     D             TO RTOX TQE
          LXI     D,CVTTOX      CVTTOX IS CURRENT TIME SINCE 0 IN TIMER
          XCHG                  FOR CORRECT COMPARE ORDER
          CALL    COMPTOX       CARRY SET IF PASSED TIME TO ACT
          JNC     NOTNOW        STILL TO GO, GO SET TIMER
          LHLD    CVTTQE        TIME'S UP, TAKE TQE OFF LIST
          MOV     E,M           GET NEXT TQE ADDRESS FROM FIRST
          INX     H
          MOV     D,M
          INX     H
          XCHG
          SHLD    CVTTQE        AND MAKE IT FIRST
          XCHG                  NOW GET PARM FOR DONOW FROM TQE
          MOV     E,M
          INX     H
          MOV     D,M
          XCHG
          CALL    DONOW         PERFORM SCHEDULED ACTION
          JMP     FIG           NOW GO SEE IF OTHER EVENTS EXPIRED
NOTNOW    LHLD    CVTTQE        DECIDE IF NEXT EVENT WITHIN 127 MS
          LXI     D,7           OFFSET TO LAST BYTE OF FIRST RTOX
          DAD     D             TO FIRST RTOX
          LXI     D,CVTTOX+3    LAST BYTE OF CVTTOX
          XCHG                  RIGHT SUBTRACT ORDER
          CALL    DIF127        SUBTRACT GIVING ONE BYTE RESULT
; IF DIFFERENCE IS OVER 127, DIF127 RETURNS TO NEXT INSTRUCTION,
; IF NOT, IT SKIPS OVER NEXT INSTRUCTION ON RETURN
SET127    MVI     B,127         SET TIMER CAPACITY
          LXI     H,CVTTOX+3    ADD NEW TIMER VALUE TO CVTTOX
          MOV     A,B
          CALL    ADAB          COMPUTE NEW TIMER TOX
          IN      253           ADD EXTENSION TO CURRENT TIMER VALUE
          ADD     B
          OUT     253           AND UPDATE TIMER
          POP     D             RESTORE REGS
          POP     B
NOCLK     EQU     *
; CHECK OTHER DEVICES ON THIS INTERRUPT LEVEL HERE
          POP     PSW           RESTORE REMAINING REGS
          POP     H
          EI                    RESTORE NORMAL INTERRUPTIBILITY
          RET                   AND RESUME WHATEVER WAS INTERRUPTED
```

Program 4. Timer Interrupt Service Routine.



It's just like programming, Harold. You 'jump', 'move', 'push' and 'pop'.



"What other qualifications do you have?"


```
LABEL   OP      OPERANDS        COMMENTS
; THE FOLLOWING IS THE DATA AREA USED BY ALL OF THESE ROUTINES
CVTTOX  DB      0,0,0,0         INITIAL TIME OF DAY 00:00:00.000
CVTTQE  DB      0,0             POINTER TO LIST OF TQE's (NONE)
; ADATOT ADDS A SIGNED ACCUMULATOR VALUE TO A 4 BYTE TIME WHOSE
; LAST BYTE IS POINTED TO BY HL
ADATOT  ANA     A               DETERMINE SIGN OF ACCUMULATOR
        RZ                      DONE IF ADDING ZERO
        JP      ADAB            GO ADD POSITIVE ACCUMULATOR
        CMA                     NEGATE NEGATIVE ACCUMULATOR
        INR     A               TWO's COMPLEMENT. THEN SUBTRACT
SUBAB   PUSH    B               SAVE REGISTER
        MOV     B,A             SAVE SUBTRACT AMOUNT
        MOV     A,M             LEAST BYTE OF TIME
        SUB     B               SUBTRACT
        POP     B               RESTORE
        MOV     M,A             UPDATE TIME
        RNC                     DONE IF NO BORROW (CARRY FLAG)
        DCX     H               TO NEXT MORE SIGNIFICANT BYTE
        MOV     A,M
        SUI     1               BORROW
        MOV     M,A             AND UPDATE TIME
        RNC                     DONE IF NO BORROW
        INX     H               FIXUP RADIX 60000 UNDERFLOW
        MOV     A,M             GET LEAST BYTE AGAIN
        ADI     L(60000)        AND ADD BORROWED 60000
        MOV     M,A
        DCX     H               TO NEXT BYTE AS WELL
        MOV     A,M
        ACI     H(60000)        COMPLETE BORROW BACK
        MOV     M,A
        DCX     H               NOW BORROW FROM MINUTES
        MOV     A,M             MINUTES
        SUI     1               BORROW
        MOV     M,A
        RNC                     DONE IF NO HIGHER BORROW
        MVI     M,59            BORROWED HOUR (60-1)
        DCX     H               AND BORROW THE HOUR
        DCR     M
        RET
; SBAFRT SUBTRACTS A SIGNED ACCUMULATOR FROM A 4 BYTE TIME WHOSE
; LAST BYTE IS POINTED TO BY HL
SBAFRT  ANA     A               TEST SIGN
        RZ                      DONE IF SUBTRACTING ZERO
        JP      SUBAB           GO SUBTRACT POSITIVE ACCUMULATOR
        CMA                     NEGATE NEGATIVE ACCUMULATOR
        INR     A               TWOS COMPLEMENT. THEN ADD
ADAB    ADD     M               ADD TO LEAST BYTE OF TIME
        MOV     M,A             AND UPDATE
        DCX     H               AND PROPAGATE CARRY
        MOV     A,M
        ACI     0               ADD IN CARRY
        MOV     A,M             UPDATE TIME
        CPI     H(60000)        DID WE OVERFLOW 59999 LIMIT OF RADIX
        RNZ                     NO, OK IF THIS BYTE DIFFERS
        INX     H               MAYBE, CHECK LEAST BYTE
        MOV     A,M             INITIALLY PRESUME SO AND FIXUP
        ADI     256-L(60000)    ROLL 60000 TO 0, 60001 TO 1, ETC
        RNC                     THIS SHOULD CARRY IF OVER 60000
        MOV     M,A             ACTUALLY UPDATE TIME
        DCX     H
        MVI     M,0             AND FIX OTHER MS BYTE
        DCX     H
```

SENSE LINE

Vectored from Page 52

As the club developed, it was felt that the club newsletter should be expanded to report on all activities and include worthwhile articles from members and from other club newsletters. We have not missed a single monthly issue. The newsletter is now 20 pages in size. We accept advertising (limited to 25% max of available space) but we do not solicit it. The advertising covers a little over half of our printing and mailing expenses. We therefore found it necessary to increase our 1977 dues to $4 and our 1978 dues to $5.

We exchange newsletters with many other clubs across the country; any other club wishing to do this should write to me at: ACG-NJ, 1776 Raritan Road, Scotch Plains, New Jersey 07076. Anyone who would like to receive a sample newsletter can do so by sending 50¢ to the above address.

```
        MOV   A,M       AND ADD THIS CARRY TO MINUTES
        INR   A
        MOV   M,A
        ADI   256-60    FIX EXCEEDING 60 RADIX
        RNC             RETURN IF NO FIX NEEDED
        MOV   M,A       APPLY FIX
        DCX   H         AND CARRY TO HOURS
        INR   M
        RET
; DIF127 RETURNS THE DIFFERENCE OF TWO 4-BYTE TIMES, IF THEY
; DIFFER BY 127 OR LESS. IT SKIPS 2 BYTES ON RETURN IF THE
; SUBTRACTION WAS POSSIBLE. PERFORMS M(DE)-M(HL).
DIF127  LDAX  D         SUBTRACT LEAST BYTES
        SUB   M
        RM              DIFFERENCE OVER 127 IF MINUS
        MOV   B,A       SAVE DIFFERENCE
        DCX   H         TO MORE SIGNIFICANT BYTES
        DCX   D
        LDAX  D         NEXT DIFFERENCE
        SBB   M         INCLUDING BORROW
        RNZ             MUST BE ZERO FOR SMALL DIFFERENCE
        DCX   H         TO MINUTES
        DCX   D
        LDAX  D
        SBB   M         COMPARE AND BORROW
        RNZ             MUST BE ZERO
        DCX   H         TO HOURS
        DCX   D
        LDAX  D
        SBB   M         COMPARE AND BORROW
        RNZ             MUST BE ZERO
        POP   H         GET ORIGINAL RETURN ADDRESS
        INX   H         AND SKIP FORWARD 2 BYTES
        INX   H
        PCHL            MODIFIED RETURN
; COMPTOX COMPARES TIMES AT M(HL) AND M(DE) SETTING FLAGS
COMPTOX LDAX  D         COMPARE SUCCESSIVELY LESS SIGNIFICANT
        CMP   M         BYTES STILL UNEQUAL
        RNZ             LESSER BYTES WON'T CHANGE COMPARE
        INX   D
        INX   H
        LDAX  D         COMPARE MINUTES
        CMP   M
        RNZ
        INX   D
        INX   H
        LDAX  D
        CMP   M         COMPARE 256 MS UNITS
        RNZ             LAST BYTE WON'T CHANGE COMPARE
        INX   D         LAST BYTE WILL DETERMINE COMPARE
        INX   H
        LDAX  D
        CMP   M         SET FINAL COMPARE FLAGS
        RET             DONE
; DONOW IS A PROGRAM TO EFFECT SOME ACTION WHEN THE TIME IS EXPIRED.
; SINCE IT RECEIVED SOME DATA FROM THE STIMER CALL, INDIVIDUALIZED
; ACTION IS POSSIBLE. TYPICALLY, DONOW SHOULD BE A VERY FAST
; SUBROUTINE WHICH OPERATES WITH INTERRUPTS DISABLED. IN THE
; CONTEXT OF A LARGER SYSTEM, THE ACTION SHOULD BE TO TELL THE
; SYSTEM TO RUN A PROGRAM WHEN INTERRUPTS ARE ENABLED LATER.
;
; DUMMY DONOW WHICH DOES NOTHING
DONOW   RET
```

Program 5. Internal Subroutines

Our regular club meetings, held once a month, now have about 300 attending. A typical meeting starts with tutorial sessions, in small rooms off the main room (beginning at 6:30 PM and ending at 8:30 PM). In another room we have a very active Flea Market. At 8:30 we hold a random-access session followed by a featured speaker/presentation. For example, the February meeting features a panel of members, discussing their different experiences with their floppy disc systems.

At our October 1977 meeting we ran an amateur computer contest, in which we awarded $600 in cash, prizes and trophies in three categories: software, hardware and applications.

We are glad to assist other clubs and invite them to contact us.

NEW PRODUCTS

ESAT 100

RHS Marketing has available its Economical Stand Alone Terminal Board. The ESAT-100 comes either as a kit or assembled and tested. Both versions include on board regulated power supplies that will provide power for both the terminal board and any 5 volt keyboard with a 200 milliamp maximum requirement. All IC's are fully socketed, P.C. board is solder masked both sides, power transformer and edge connector included making the ESAT-100 a complete package. All that is needed to make it operational are a 5V keyboard and a video monitor.

Data I/O is serial asynchronous, 11 unit code, TTL compatible. Baud rates are adjustable 300, 600, 1200, 2400, 4800, 9600. Display is 32 characters per line, 16 lines, 2 pages. Also available is an optional piggy back conversion board that will expand the ESAT-100 to 64 characters per line by 16 lines. Features of the ESAT-100 include full cursor control, functions of backspace, forward space, line feed, reverse line feed, home, return to end of line. The block seethru cursor completely surrounds and inverts any character it overlaps. Other operator controls are: full/half duplex, local/remote, cursor on/of, parity enable, odd/even parity. Power in the initialization clears both pages and homes cursor. Lower case code is automatically converted to upper case. An 8 bit parallel input port can be used for a keyboard on the other devices. The output is composite video-horizontal sync, vertical sync, cursor and character display are combined into a single 75 connection into a T.V. video amp or video display monitor.

Unit price for the ESAT-100 terminal board kit is $185.00 and $239.00 for built and tested. For further information contact RHS Marketing, 2233 El Camino Real, Palo Alto, CA 94306, (415) 321-6639.

CIRCLE INQUIRY NO. 126

Fully Static 64K ROM — in VMOS

American Microsystems, Inc. has begun deliveries of a 64K ROM fabricated with the new VMOS technology.

Designated the S4264, the 8K x 8 ROM yields substantial cost reductions by reducing the number of parts required, simplifying printed circuit boards and eliminating the need for clock signals to the ROM. In addition, the S4264 offers a maximum access time of 350 nanoseconds and reduces the power requirements to only 145 milliwatts maximum for the 65,536 bit chip.

The 64K ROM is contained in a 24-pin package and requires a single socket to replace four 16K ROMs in existing designs for display terminals, plug-in computer language modules and numerous control applications in, for example, video games or industrial controls.

Evaluation products are available. Prices are negotiated on the basis of quantities ordered, but will be about $50.00 in quantities of 500. For more information contact American Microsystems, Inc., 3800 Homestead Rd., Santa Clara, CA 95051, (408) 246-0330.

CIRCLE INQUIRY NO. 138

Highly-Intelligent Data Handler

A highly-intelligent data-handling and recording peripheral, from August Technology Corporation, provides multiple input/output channels, data-manipulation capabilities, and recorded storage capacity to 580K bytes per cassette. The ATC Model 7701 interfaces directly with the Hewlett-Packard 9800 Series calculators, the Wang 2200 and the IBM 5100 desk-top computer.

Incorporating an 8080 microprocessor and up to 64K words of memory, the Model 7701 provides up to 10 TTY current-loop, synchronous or asynchronous RS-232 ports, and an 8-bit parallel data bus. Data may be recorded and played back on a Phillips-type cassette through any port on the bus at the same or different rates. Data may also be transferred among ports and the bus without recording.

The 7" high by 17" wide by 13" long unit weighs less than 25 pounds. Power consumption is 100W when operating from a 117V or 230V, 60Hz line. Operating temperature is 0 to 50°C.

The model 7701 is priced from $3250 to $5000 depending upon the number of ports specified, interface required, memory and options. Delivery is 60-90 days ARO. For information contact August Technology Corp., 2040 N. Maplewood St., Orange, CA 92665; (714) 998-1639.

CIRCLE INQUIRY NO. 137

Artec Expands Breadboard Line

Artec Electronics has expanded its line of general-purpose breadboards and now offers design engineers an even broader choice of designs for industrial applications.

Latest addition to the line is the high-density, wire-wrap model designed to hold 147 16-pin wire-wrap sockets. Designated the 126E, it measures 7.9 inches wide by 12.20 inches high and is a 100-pin board with a .125 gold plated connector and patterns on both sides.

The 126E joins a growing family of general-purpose standard boards that come in configurations ranging from 4.50" wide by 4.25" high to 13.25" wide by 7.50" high.

The Artec 120 model offers a 14 and 16 dual-in-line pin, while the 118 version can accommodate various sockets. Artec 108 features plated-thru holes on .10 grid centers and can be used to perform a number of prototyping steps. The 116 model, on the other hand, holds several pins and will accept bypass capacitors.

In all, more than 30 types of general-purpose breadboards in various configurations, pin sizes and densities are available. All boards have power and ground and are made on .062 epoxy glass. With the exception of the 100-pin 126E, all the boards have .156 centers and 44-pin gold-plated edge connectors.

Prices on the Artec general-purpose breadboards vary according to card sizes. For more information contact Artec, 605 Old Country Rd., San Carlos, CA 94070, (415) 592-2740.

CIRCLE INQUIRY NO. 139

Modular Microcomputer

The Astral 2000, based on the 6800 microprocessor, is available as a stand alone single board computer or in one of two enclosures complete with power supplies and 12 position mother board.

The Astral 2000 is particularly valuable for a broad range of uses because of its modular design. Separate cards contain the processor, memory, I/O and floppy disc interface. The system is fully supported with an extended 8K BASIC, Assembler, Text Editor and Disc Operating System Software (DOS). Two separate interchangeable front panels are also available. All system cards are 10" by 4.5" to fit into limited space and have standard dual 22 pin edge connections.

For prices and additional information contact Astral Computer Co., 991 Commercial St., Palo Alto, CA 94304, (415) 494-8048.

CIRCLE INQUIRY NO. 141

Electro-Wash Professional 'Super Solvent'

Electro-Wash® is a heavy-duty aerosol cleaner/degreaser that's ideal for electronic, electrical and mechanical applications. When teamed-up with Vibra-Jet® , the company's aerosol pulsating attachment, the combined portable unit has the cleaning power of an ultrasonic bath, without the bulk or expense.

Electro-Wash, a concentrated blend of Freon* solvents, is extremely effective in penetrating, dissolving and washing away accumulated gunk, grease, dirt and oxidation from the most delicate assembly without damage. The chemical is safe for plastics, evaporates quickly without leaving residue, has excellent dielectric properties and is non-flammable for complete safety. Owing to its high degree of purity and effectiveness, Electro-Wash meets all stringent Federal and Military specifications for such products.

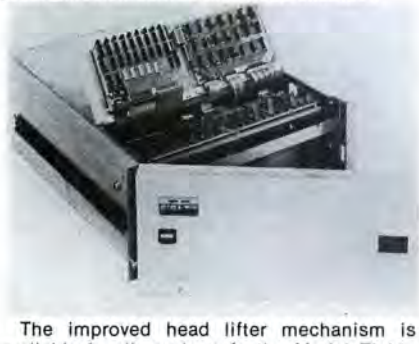
Price for 24-ounce of Electro-Wash is $3.80. Patent-panding, reusable Vibra-Jet price is

$1.98. Electro-Wash products are available through distributors everywhere. For more information contact Chemtronics, inc., 45 Hoffman Ave., Hauppauge, NY 11787, (212) 895-1930 or (516) 582-3322. *Reg. DuPont trademark.

CIRCLE INQUIRY NO. 129

Advanced Head-Per-Track Magnetic Disc Memory System

Further advances in large-capacity rotating head-per-track magnetic disc memories have been announced by Alpha Data, Incorporated. Alpha Data's patented, automatic recording head lifter has been improved even further. The new version literally locks up the heads when the equipment is not operating. This substantially increases equipment reliability by allowing it to survive without damage the critical phases of transportation, installation, and handling. Concurrently, its ability to withstand shock during operation is assured by providing high-pressure air-bearings for the recording heads which are sealed in an environment-proof, shock-mounted disc/head chamber.



The improved head lifter mechanism is available in all versions fo the Model Eighty series, which has a maximum capacity of 64 million bits (8 megabytes) per spindle. Up to eight of these devices can be daisy chained with any one of the Alpha Data computer controllers to provide an unprecedented head-per-track capacity of 64 megabytes, with an average access time of 8.5 milliseconds.

For more information contact Alpha Data, Inc., 20750 Marilla St., Chatsworth, CA 91311, (213) 882-6500.

CIRCLE INQUIRY NO. 136

MCI Offers IDS

Metronix Computers, Inc., announces its new Independent Dealer Service program to supply independent computer stores througout the United States with high quality computer systems, peripherals and supplies from major mini/micro manufacturers. The program offers the advantages of buying from a single source; discounts up to 25%; sales leads generated from a national advertising program, and a low, one-time $2,000 initial order requirement designed not to burden dealers' cash flow situation.

For additional information, contact MCI, 25 E. 9th Court, Hialeah, FL 33020, (305) 885-4700.

CIRCLE INQUIRY NO. 141

F-8 Microcomputer

Comptronics announces an F-8 microcomputer on a single board.

Designed especially for low cost hardware and software development and evaluation, the Model 1080 F-8 Development Board consists of an F-8 CPU, a FAIRBUG PSU, a 3853 SMI, 2Kx8 of RAM, 2.0 MHz crystal and interfacing componentry on an 8"x13" printed circuit board.

Aimed primarily at the design engineer, experimenter and serious hobbyist, the development board also contains a buffered address and data bus to a S-100 memory expansion connector, and provides sockets for 4K of 2708 memory. The unit provides 1K of 2708 user custom monitor, and has 32 bits of I/O arranged in four 8-bit ports.

The microcomputer provides for RS 232 or 20ma curent loop support circuitry, two sockets for I/O expansion and many other features. Complete documentation is included in the basic price. The Model 1080 Development Board is being introduced at $249 as a kit, or $299 assembled.

For further information contact Comptronics, 19824 Ventura Blvd., Woodland Hills, CA 91364, (213) 340-8843.

CIRCLE INQUIRY NO. 134

Hard Disc, Bundled Business Computer

Basic/Four Corporation, an MAI company, announces a new low-cost, hard disc, bundled business computer featuring program packages that have the flexibility of customized programming with the economy of preprogrammed software.

Called the BASIC/FOUR System 200, the new system consists of a BFC-manufactured central procesosr, 32K memory, 10 megabytes fixed media Winchester-type drive, a video display terminal, a cartridge tape drive, and a 120 character per second bidirectional printer.

The nine module application package available with the system includes accounts receivable, accounts payable, general ledger, sales

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hi-speed reliability at a very affordable price

Newest and lowest-cost member of the Centronics user-oriented 700 Series serial printers. The simple alternative to more expensive, more complex printers.

- 80 to 132 characters, selectable, per line
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- unidirectional printing
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$1345 CROMEMCO Z2-D

disk drive

fast, rugged, professional-grade computer

Take a step forward with this thoroughly professional unit designed for engineering, science, production, business, education. To make it even more enticing, you save $150 if you buy now.

- Fortran and Basic available now
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- Z-80 processor
- each 5" disk stores up to 92K bytes
- shown with optional aluminum cabinet, $195

IMSAI 80/15

$699

just add love, one tv, and a little memory

New! Available now at a special introductory price. Simple, easy to use operator's panel. Comes with 10-slot terminated and regulated mother board. Video output capability, naturally.

- 8085 processor, MHZ-3 clock rate
- parallel & serial ports
- optional: fully-slotted, wave soldered mother board, $75

$275

IKB-1

Intelligent Keyboard

- parallel & RS-232 interfaces
- user-programmable key functions
- ASCII encoded

SOROC IQ 120

more value for your dollar than any other terminal

$995

The capable remote video display terminal with a multiple of features. Fully assembled and tested. Upper and lower case, 24 lines, 80 character display.

- 10 key numeric pad, and auxiliary port
- auto repeat tabbing, and addressable cursor
- field protect with dual density
- Option 1: block mode & screen print interface, $100

See these products at the following Micro Age locations:

Phoenix Byte Shop	Tempe Byte Shop	Tucson Byte Shop	Dallas Byte Shop	Service Center
24 W. Camelback	813 N. Scottsdale Rd.	2612 E. Broadway	1474 W. Spring Valley Road	803 N. Scottsdale Rd.

ORDER FORM

Item	Price	QTY	Amount
CENTRONICS 779	$1175		
optional tractor fees	100		
CROMEMCO Z2-D	1345		
optional cabinet	195		
IMSAI 80/15	699		
optional mother board	75		
IKB-1 keyboard	275		
SOROC IQ 120	995		
Option 1	100		
40-pg. BYTE SHOPPER GUIDE	2.50		
	TOTAL		

(Free shipping in U.S. for all items except Z2-D).

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(602) 894-1193

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☐ Money Order
☐ Master Charge* (save time...call collect on credit card orders)
☐ VISA*

*Card No. _____
Interbank No. _____ Exp. date _____

Name _____
Address _____
City _____ State _____ Zip _____

analysis, purchase order processing, order processing, fixed assets, inventory control and payroll.

Complete price for the System 200 with the accouting system package is $29,000; deliveries begin late February. For more information contact Basic/Four Corp., P.O. Box C-11921, Santa Ana, CA 92711, (714) 731-5100.

CIRCLE INQUIRY NO. 135

Solid State Timers

The Cramer Division of Conrac Corporation has available new plug-in solid state timers as part of their total line. The timers are manufactured in 21 versions, ready for "off the shelf" delivery from Cramer distributors across the country.

Cramer designed the line around the five most used types: "on" delay, extended "on" delay, "off" delay, itnerval, and pulse or cycle timing. All the timers feature calibrated dials and adjustment knobs. Cycle timers have two knobs for independent adjustment of on and off times. The extended "on" delay timers have the additional feature of a timing indicator lamp. All stock models are for 120VAC operation, with 10-amp DPDT output contacts.

For more information contact Cramer Divisoin, Conrac Corp., Mill Rock Road, Old Saybrook, CT 06475, (203) 388-3574.

CIRCLE INQUIRY NO. 130

Rack Mountable Keyboard/Display Unit

Computerwise, Inc. is offering a low-cost, rack mountable keyboard/display unit for use in computer controlled machines, automatic testers and similar applications.

The unit can be attached to any computer or microprocessor using an asynchronous RS-232 or 20mA current loop I/O port. Switches allow the user to select the operating mode including: 110-9600 baud rate, full or half duplex, even/odd/no parity, 5 to 8 data bits and one or two stop bits. The unit mounts in a standard 19 inch wide equipment rack and requires 10½ inches of panel height.

A gas discharge display provides a single line of up to 32 alphanumeric characters. Each character is formed using a .2 inch high 5x7 dot matrix which provides excellent legibility.

Keyboard options available include the 24 key format shown, a 53 key full alphanumeric model or a custom configuration to meet the customer's unique requirements.

The standard unit is available in 30 days for $750.00 in singles with discounts for larger quantities. For more information contact Computerwise, inc., 4006 E. 137th Ter., Grandview, MO 64030, (816) 765-3330.

CIRCLE INQUIRY NO. 132

Versatile Logic Monitors 'See' Inside ICs

Continental Specialties Corporation offers a way to peek inside the black box of digital DIPs: 16-channel clip-on Logic Monitors. An LED at each pin indicates the state of that pin by lighting or remaining dark.

By monitoring an entire 14 or 16-pin DIP at once, CSC's Logic Monitors reveal the action of the package as a whole, permitting easy and often instant insight into its behavior or misbehavior.

The model LM-1 Logic Monitor tests DTL, TTL, HTL and CMOS logic families. Individual comparators at each pin drive individually labeled LEDs "on" for a HIGH, and "off" for a LOW logic level. It carries a suggested resale price of $74.95.

The model LM-2 Logic Monitor includes a fully isolated line-operated power supply to eliminate test circuit loading. Suggested

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resale price is $129.95 for standard 117 VAC 50/60 Hz operation, 10% more for 220 VAC 50/60 Hz operation.

Information is available from CSC dealers and distributors, or contact Continental Specialties Corp., 70 Fulton Ter., New Haven, CT 06509, (203) 624-3103.

CIRCLE INQUIRY NO. 133

Intel Offers Add-on Memory for IBM 3000 Series Processors

Intel Memory Systems announces the first semiconductor add-on memory for IBM Model 3031, 3032 and 3033 large-scale computers. The in-7730 memory system, based on Intel's 2147 static RAM, is completely hardware and software compatible with any of the IBM 3000 series processors through the use of an interface card set.

Memory compatibility with all three IBM 300 series processors is achieved through an interface unit which converts logic levels for the address, data and controls between the in-7730 and the CPU.

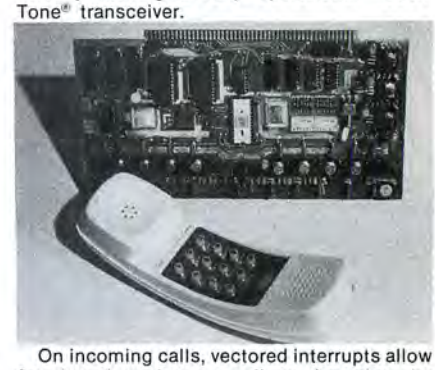
The in-7730 can provide up to 8 megabytes of add-on memory, depending on the CPU. The unit is 60 inches high by 40 inches wide by 27 inches deep and features its own cooling and power systems.

One megabyte of in-7730 memory is priced at $65,000. It leases for $1650 a month on a 48 month lease. Deliveries are scheduled to begin in October 1978. For more information contact Intel Memory Systems, 1302 N. Mathilda Ave., Sunnyvale, CA 94086, (408) 745-7120.

CIRCLE INQUIRY NO. 116

MK-II Interfaces Touch-Tone® Telephone and Altair/Imsai S-100 Bus Computers

For those interested in bringing the microcomputer into the home, MK Enterprises has a Dual Tone Multi-Frequency (DTMF) transceiver board which interfaces your S-100 microcomputer to the Touch-Tone® telephone. Designated the MK-II, the board converts Bell System's DTMF into binary and binary into DTMF, thereby making a fully operational Touch-Tone® transceiver.



On incoming calls, vectored interrupts allow for ring detection as well as detecting the presence of DTMF signaling. This capability permits one to execute programs by calling up his computer and punching buttons on his Touch-Tone® telephone. A 4-bit input port allows additional data to be transferred coincident with decoded DTMF.

On outgoing calls, digits dialed are loaded into a FIFO buffer at processor speed and unloaded into a DTMF generator at a rate compatible with Bell System's C.O. equipment. A 4-bit output port makes possible the supervision of trunk interface equipment (DAA devices). Single tones may be generated instead of dual tones under software control.

The MK-II comes fully assembled and tested with applications information and manual for $425.00. Delivery takes 4-6 weeks. For further information contact MK Enterprises, 8911 Norwick Rd., Richmond, VA 23229, (804) 285-2292.

® Registered trademark of AT&T.

CIRCLE INQUIRY NO. 119

The Logical Force™ Sourcebook

Continental Specialties Corporation is heralding the arrival of its new family of inexpensive digital troubleshooting hardware which they call The Logical Force™ with an informative manual entitled "The Logical Force Sourcebook."

The Logical Force includes three logic probes. Logic Probe 1 (Model LP-1), the Standard Logic Probe, boasts a 50nsec speed at $44.95. Logic Probe 2 (LP-2), the Low Cost Probe, manages 300nsec for just $24.95. Logic Probe 3 (LP-3) the High Speed Probe, handles 10nsec pulses at $69.95.

Also included is a digital pulser, Digital Pulser 1 (DP-1) at $74.95. And CSC's Logic Monitors (LM-1 and the self-powered multi-family LM-2) are also featured.

For further information contact Continental Specialties Corporation, 44 Kendall St., New Haven, CT 06509, (203) 624-3103.

CIRCLE INQUIRY NO. 131

INFO 2000 Low-Cost Business System

INFO 2000 Corporation announces their new computer system for small business data processing. The INFO 2000 Business System competes in performance and functional cap-

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ability with minicomputer systems now selling for over $30,000. The complete system consists of a Z80 based computer, dual flexible disc drives, high speed printer, video terminal and extensive business applications software.

The mainframe employs the S-100 bus architecture and contains the powerful, high speed Z80 CPU, up to 56K of RAM memory, 8K of EPROM, a filtered forced-air cooling system, and heavy duty power supply.

Mass storage is provided with PerSci dual flexible disc drives. The printer is a 160 CPS, 132-column line device which provides all 95 ASCII upper/lower alphanumeric and graphic characters, including the true lower case letters with descenders. Printer capabilities include graphing and charting. The video console uses a commercial quality keyboard with numeric keypad. The video console displays all ASCII characters.

All necessary operating software is included with the INFO 2000 Business System, designed to enable even the novice to begin processing data the first day of operation.

First deliveries are scheduled for February, 1978. Delivery time from receipt of orders is 15-30 days. The INFO 2000 Business System is priced under ten thousand dollars. For complete details contact INFO 2000 Corp., 20630 S. Leapwood Ave., Carson, CA 90746, (213) 532-1702.

CIRCLE INQUIRY NO. 120

Add A Full Size Impact Printer To Your Computer

Here's everything you need to convert your IBM Selectric typewriter into a hard copy output terminal: interface, power supply, plus all necessary mechanical parts and solenoids. Complete instructions included.

Why pay a small fortune for a hard copy output terminal? ESCON conversion kits let you convert a standard IBM Selectric typewriter into a quality printer in just a few hours. No holes to drill. No mechanical genius needed. And no changes in the appearance or normal operation of your IBM Selectric once conversion is complete.

Compatible with most computer systems utilizing the S-100 bus. Consists of a single card utilizing parallel output, ASCII coded. A status byte indicating completion of the operation is provided, with polarity and position determined by user. Maximum bus loading is limited to one LS-TTL input. The status driver will sink 24mA or source 15mA to the bus. The multiple pin connector is compatible with all S-100 mother boards. Power supply is optional.

For more information contact ESCON, 1235 Tenth St., Berkeley, CA 94710, (415) 524-8664.

CIRCLE INQUIRY NO. 125

LPA11-K

The LPA11-K controller utilizes FORTRAN calls, and transfers analog data at an aggregate rate of up to 150,000 samples per second.

High-speed rates are achieved by the controller's use of direct memory access. This method also enables a 60 tp 80 percent reduction in CPU overhead rates as compared to previous techniques.

The LPA11-K operates under the RSX-11M operating system on all PDP-11 computers with UNIBUS I/O. Two modes of operation are available: single user, to achieve high throughput rates; and multi-user, where up to eight users can control experiments and processes simultaneously. Both modes of operation are supported through FORTRAN calls.

The LPA11-K incorporates two microprocessors to control data and command transfers between laboratory peripherals and the PDP-11 central processor. The input/output bus of the controller was designed to accommodate standard LDP UNIBUS interfaces without modifica-

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North Star Horizon Single Drive System includes the Z-80 CPU at 2 or 4 MHz, motherboard, 16K of memory at 4 MHz and power supply. Software includes Disk Operating System and Disk BASIC. Horizon 1 kit is $1599. Dual Drive Horizon is also available at $1999.

We add monitor and keyboard.

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Dual Drive $395.00

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You get the Horizon 1 complete with North Star Disk BASIC. A complete business package on diskette is available for $295, and includes:

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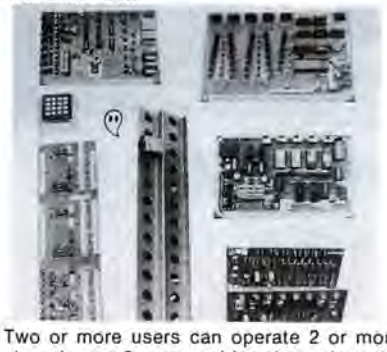
tion. The LPA11-K plugs into one of the UNIBUS slots, enabling field upgrade of UNIBUS-based PDP-11 systems.

The LPA11-K is priced at $4,985. For further information contact Digital Equipment Corp., Maynard, MA 01754, (617) 481-9511.

CIRCLE INQUIRY NO. 128

GHOST

The GHOST is the Gimix House Operating System Technology. It makes your system do what you tell it, or it does what you want without being told. The Ghost has a long memory: Commands may be entered up to one year before execution.



Two or more users can operate 2 or more keyboards over 2 or more video channels at the same time. Anyone who can operate a push-button phone can operate this system. Video based and designed so that every TV is a readout as well. 16-button, 2-wire keyboards can be easily wired anywhere and everywhere. You can operate Ghost from practically anywhere, not just at the computer.

The flexible system can be used by a novice, or the most sophisticated hobbyist. Customize your needs through component boards. Can be readily expanded as your needs grow.

All boards assembled and tested 100%. Solder masked, using only top quality components designed for lowest power consumption and coolest operation.

For more information on GHOST, contact Gimix, Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 927-5510.

CIRCLE INQUIRY NO. 123

The Electric Pencil

The Electric Pencil is a character oriented word processing system. This means that text is entered as a continuous string of characters and is manipulated as such. This allows the user enormous freedom and ease in the movement and handling of text. Since lines are not delineated, any number of characters, words, lines or paragraphs may be inserted or deleted anywhere in the text. The entirety of the text shifts and opens up or closes as needed in full view of the user. The typing of carriage returns as well as word hyphenation is not required since each line of text is formatted automatically. As text is typed in and the end of a screne line is reached, a partially completed word is shifted to the beginning of the following line. Whenever text is inserted or deleted, existing text is pushed down or pulled up in a wrap around fashion. Everything appears on the video display screen as it occurs which eliminates any guesswork. Text may be reviewed at will by variable speed scrolling both in the forward and reverse directions.

By using the search or the search and replace function, any string of characters may be located and/or replaced with any other string of characters as desired. Specific sets of characters within encoded strings may also be located using this powerful function.

When text is printed, The Electric Pencil automatically inserts carriage returns where they are needed. Numerous combinations of line length, page length, line spacing and page spacing allow for any form to be handled. Character spacing and bi-directional printing are included in the Diablo versions. Right justification gives right-hand margins that are even. Pages may be numbered as well as titled.

Available on cassette or diskette (add $25.00 for disc version) in various configurations. For mail order or information, contact Michael Shrayer, 3901 Los Feliz Blvd., #210, Los Angeles, CA 90027, (213) 665-7756.

CIRCLE INQUIRY NO. 124

Low-Cost Word Processing System

Based on a powerful general-purpose 8080 microcomputer with floppy disc mass storage, this new work processing system is probably the most simple to operate. Within just a few minutes anyone can begin to use the system, whether he or she has had prior computer experience or not. Corrections, additions, deletions, or movement of characters, words, phrases, even blocks of several paragraphs, are accomplished in a simple and direct manner. All text copy is edited on a video screen in full view of the operator.

For the businessman, this means a much greater output of letters, reports and other printed matter is possible since rough drafts and other intermediate steps can be eliminated. Printing is high speed and flawless. "Stock" blocks of text can be stored separately and included in any letter or report. Form letters can be called up, then edited as necessary, to personalize them and avoid a "canned letter" appearance.

If desired, the system may also serve double duty as an extra-smart terminal on an existing computer system, or even as a stand-alone computer.

For information contact Computer Center, 1913 Harbor Blvd., Costa Mesa, CA 92627, (714) 646-0221.

CIRCLE INQUIRY NO. 115

Film Capacitors

A complete line of tubular, hermetically sealed film capacitors resistant to moisture, humidity and temperature and immersion cycling are available from W-K Industries.

W-K Industries Series DL-Style capacitors have a metallized mylar dielectric, extended foil construction and tin-plated, copper-clad steel wire axial leads. Hermetically sealed in a cylindrical, tin-plated metal tube with soldered glass end seals, the capacitors are designed for use in harsh environments in a broad range of general electronic applications.

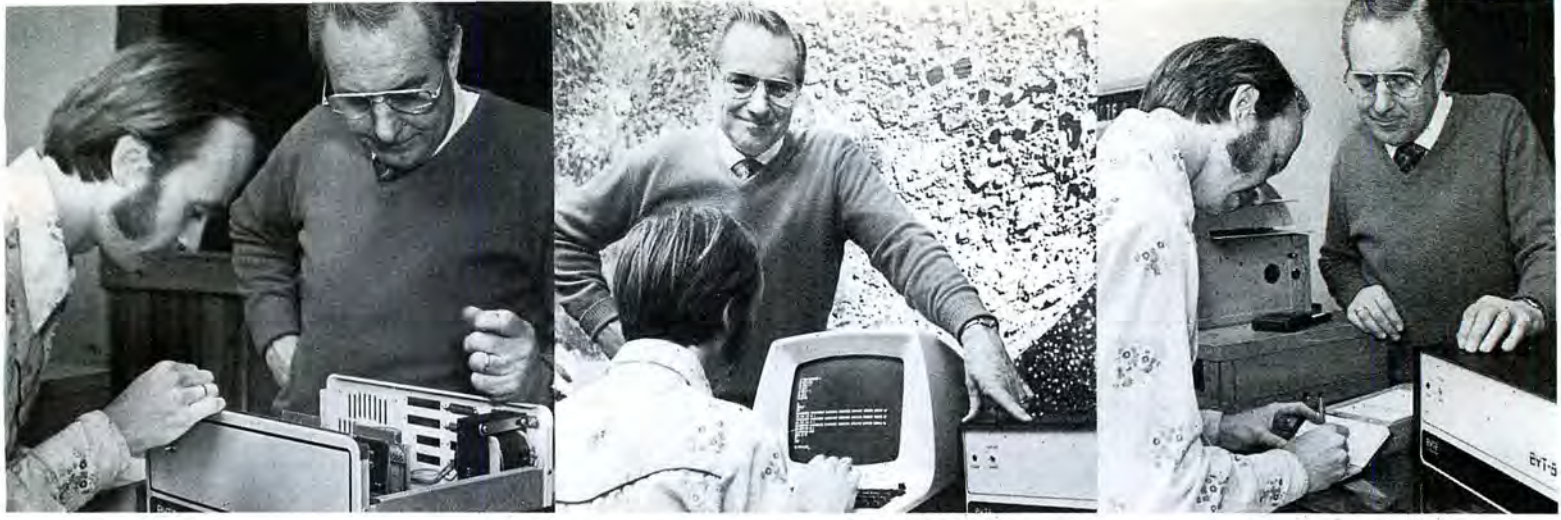
Operating temperature range is -55°C to +125°C, with linear voltage derating of 50% from 85°C to 125°C.

For additional information on tubular, hermetically sealed metallized mylar capacitors, Series DL-Style, contact: W-K Industries, 1960 Walker Ave., Monrovia, CA 91016.

CIRCLE INQUIRY NO. 111

Digital Forms 'Family' of Educational Systems

Digital Equipment Corporation announces the formation of a family of educational com-



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CIRCLE INQUIRY NO. 70

puter systems ranging from entry-level interactive and mark sense batch systems to a multi-language timesharing system with expansion capability to serve up to 63 users.

The new family uses Digital's RT-11 and RSTS/E operating systems and spans a broad spectrum of PDP-11 processors. At the low-end, the single-user ES210/C, consisting of PDP-11/03 processor with 56K bytes of MOS memory, dual floppy disc unit, VT52 video display or DECwriter II printer terminal, RT-11 operating system and multi-user BASIC language, is priced at $15,613.

The high-end ES570 included PDP-11/70 processor with 256K bytes of memory, 176-megabyte disc unit, nine-track magnetic tape system, 300-line-per-minute printer, and DECwriter II console. Software consists of the RSTS/E operating system, BASIC-Plus-2, DECAL (Digital's CAI author language), plus one commercial language (COBOL or RPG II) and one scientific language (FORTRAN IV or APL). ES570/W prices begin at $165,060.

For more information contact Digital Equipment Corp., Maynard, MA 01754, (617) 897-5111.

CIRCLE INQUIRY NO. 127

Tape 'N Text Modular Lessons

Tape 'n Text learning programs consist of audio cassette tapes coordinated with printed texts. The learner is afforded the opportunity to hear on tape what he sees in the printed texts at the same time. In addition the audio tapes provide clarifying information not in the text.

For an additional charge of $2 a hard copy listing of BASIC programs can be ordered for each Tape 'n Text series. The programs are designed to test the learner's knowledge and skills attained at the completion of each Tape 'n Text unit. Computer hobbyists can set up their very own computer based family learning and testing center at home for the study of algebra, computer math, English, and BASIC programming language.

Several Tape 'n Text programs are available, including Program CA *Programming in BASIC*, Program MA *The Second Language and Contemporary Applications*, Program MB *Basic Math for Computers*, Program MC *Beginning Algebra Course*, Program EA *Basic Language Usage*. All contain 4 cassette tapes and 4 printed tests, individually packaged, for $19.95. For further information contact Williamsville Publishing Co., Inc. Box 237, Williamsville, New York 14221.

CIRCLE INQUIRY NO. 110

in-7700 Memory System

The in-7700, a semiconductor add-on memory system, is designed to adapt to the IBM System/370 Model 135, 138, 145, or 148 by simply changing a set of interface cards. It offers the user freedom to make a CPU upgrade without investment in another add-on memory system.

By using the 2147 4K static RAM technology from Intel Corporation, the in-7700 is fast enough to accommodate any of the four CPUs. The system interfaces directly to the CPU and is able to utilize IBM error detection and correction logic, allowing a simpler and more reliable system design.

The purchase price for 256K of in-7700 memory attached to the IBM System 370/135 or 370/145 is $45,000. Leasing cost is $1120 a month on a 48 month lease. One megabyte of memory for the 370/138 or 370/148 model costs $65,000, or $1650 a month on a 48 month lease. For more information contact Intel Memory Systems, 1302 N. Mathilda Ave., Sunnyvale, CA 94086, (408) 745-7120.

CIRCLE INQUIRY NO. 121

$29.95 S-100 Motherboard

A new eleven-card-position motherboard, for Altair/Imsai and S-100 bus-oriented microcomputer systems, provides prewired busses, power-supply lines and etched circuits for active or passive bus termination. Designated the Model 8803 by Vector Electronic Company, the new board virtually eliminates hand back-plane wiring and speeds assembly of personal-computer systems.

The Model 8803 has the features of more expensive S-100 bus motherboards, but allows system fabricators greater latitude in configuration and cost. The board has positions for up to eleven 100-pin card-edge connectors, allowing the hobbyist to install only the connectors he requires. One position may be used to interconnect to other motherboards for system expansion. Twelve tantalum capacitors are included to suppress transients on the + 5, + 12, and -12 volt busses.

For more information contact Vector Electronic Company, 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 113

Three Phase 480 Volt Solid State Contactor

Agtronics Manufacturing Company announces their new, low-cost, three phase Solid State Contactor available in 240 and 480 volt versions, with a 12 amp continuous rating and a 100 amp surge rating. These compact, solid state devices are perfect for replacing conventional electro-mechanical contactors, particularly in applications requiring a large number of cycles.

The input is optically isolated and tested to 3KV. Control voltage options cover the full range from direct low voltage I.C. operations to the conventional control voltages of 24, 48, 120, 240 and 480 VAC.

For more information call or write Agtronics Manufacturing Co., 756 Lakefield Rd., Suite C, Westlake Village, CA 91360, (805) 495-0874.

CIRCLE INQUIRY NO. 114

Jet-Flecs Round Conductor Ribbon Cable

Molex Jet-Flecs ribbon cable is manufactured under controlled techniques which produces a precision center-to-center controlled cable of predictable and consistent electrical characteristics.

The ribbon cables are available in #28 AWG Stranded (7/36) conductors. Ribbon cable design allows individual or groups of conductors to be separated from the cable through a "zipping" process. The cable is black with a yellow 1st circuit key marker.

Molex ribbon cables are UL listed at 105°C and 300 V RMS. They are also FR-1 rated under UL Flammability Specifications.

For complete details and options available contact Molex, Inc., 222 Wellington Ct., Lisle, IL 60532, (312) 969-4550.

CIRCLE INQUIRY NO. 117

BOOK REVIEWS

MOS/LSI DATA BOOK
714 pages, $4.00, Paper.

CMOS DATA BOOK
556 pages, $3.00, Paper.

MEMORY DATA BOOK
546 pages, $4.00, Paper.

National Semiconductor Corporation, 1975

Review by Judy Scolney Robertson and Larry Robertson

Each time we sit down to review a data book, we wonder why bother. All are reasonably thorough and those of our readers who need them will buy them no matter what we say. The three National Semiconductor Corporation books discussed in some detail below are especially good even though they are standard data books. They are extremely useful with their thorough descriptions and clear diagrams for the various National Semiconductor products discussed in them. Each gives a general description followed by technical specifications, major features, schematics, timing information and so on. Each book includes packaging dimensions for each of its various devices. We particularly appreciated the large quantity of applications notes and the list of terms (which is not called a glossary) complete with definitions.

The *MOS/LSI Data Book* provides detailed information on some of the more interesting special purpose chips designed and produced by National Semiconductor. Some items we found to be of interest were digital clock circuits (including wrist watches), counters and timers, electronic organ chips, TV circuits, analog to digital converters, communications chips (especially the CB radios) and calculators. An avid hobbyist would find keyboard encoders, displays, interface drivers and micros intended for use in controllers of particular interest. Of the three data books, this one comes closest to being considered just plain fun.

The *CMOS Data Book* describes CMOS products exclusively. Included are standard gates, buffers, flip-flops, counters, shift registers, multiplexers and Tristate® memories. This book discusses the special functions of many products described. Computer hobbyists will be particularly interested in the 3½-digit digital voltmeter chip, the seven-segment-to-BCD converter and the keyboard encoder.

The *Memory Data Book* describes most of National Semiconductor's line of MOS, SMOS and bipolar memories. This is the book to get if you are building your own memory. It includes MOS programmable logic arrays and shift registers. If you use National Semiconductor products, this book and its two companions are musts for your technical library.

For convenient access, these books are cross-indexed by type of part and by part number. All three books are very thorough and well-designed. If you need them, by all means buy them; if not, why did you read this far?

All three books, *MOS/LSI Data Book, CMOS Data Book* and *Memory Data Book,* are available by mail from National Semiconductor Corporation, c/o Mike Smith, P.O. Box 60876, Sunnyvale, CA 94088.

INTERFACING SELECTRICS TO MICROCOMPUTERS
By Carl Townsend.
1977, Center for the Study of the Future. 49 pages, $12.00, Paper

Review by Judy Scolney Robertson and Larry Robertson

Interfacing Selectrics to Microcomputers is a discussion of a method of using Selectric typewriters as terminals for microcomputers. The system described is one the author is currently using and he seems to be quite satisfied with it.

Our Selectric informants, on the other hand, tell us that *Interfacing Selectrics* is quite inadequate. They feel that insufficient attention is paid to the closed loop operations recommended by IBM, thus slowing down terminal operations significantly and increasing the risk of wearing out the expensive Selectric too quickly.

The interfacing methods described in this book are somewhat more complicated than need be, leading us to wonder whether the designer is a relative novice or if he is merely working in a vacuum.

Although we do not recommend following Townsend's procedures, you may find that *Interfacing Selectrics to Microcomputers* has some value. If so, it is available from Center for the Study of the Future, 4110 NE Alameda, Portland, OR 97212.

MY FRIEND THE COMPUTER and TEACHER'S GUIDE AND ACTIVITY BOOK
By Jean Rice
T.S. Denison & Co., 1976, $17.95

Review by Timothy Mowchanuk, editor of Com 3-Essendon, Australia

The 85-page text is one of the best I've seen for students at the middle school level (6th grade to form 4). It is a good introduction to the computer and could be made the basis of a computer literacy unit. To quote the advertising literature: "The book is designed to be used as a supplementary text which could be integrated into social studies, science or mathematics curriculum. It can be used with without computer equipment."

The book is written in a low key, with a non-threatening style and covers what computers are, their history, applications and programming. A teacher does not have to have very much experience with computers to use it effectively. The accompanying Teacher's Guide is a unique feature of the set, and is worth the full price by itself. It gives some background information to the text, 14 overhead transparencies illustrating material in the text, and a host of relevant spirit masters. The guide makes the set a virtually self-contained unit. It is well worth considering as a text and should be in every library of teachers concerned with computing.

"This is the one that has been acting funny."

SOFTWARE SECTION

By A. A. Perez, Software Editor

This month's issue features a legacy of valuable software. Featured on page 80 is MEDICAL RECEIPTS PACKAGE, the second in the Microbusiness series by Mal Lockwood. Although this program was designed for a medical practice, it can be easily adapted to any professional office.

Effective use of the microcomputer system in the small business or in the home requires the learning of simulation techniques to predict trends and future opportunities. MICROCOMPUTER FOR BUSINESS RISK ANALYSIS by Jon R. Prescott (page 88) serves this purpose. The information is based on the author's personal experience.

HOW TO BUY AN APARTMENT HOUSE by Richard E. Michels is an article that leads the reader, step by step, through the confusing and sometimes misleading process preceding the acquisition of income property. Real estate investments have traditionally been considered the safest type of investment. Yet within this field some of the crassest abuses have been reported. Many of the mistakes, however, are made by the prospective buyer whose lack of experience leaves him vulnerable to shell-game arithmetic techniques practiced by brokers whose total sense of social responsibility rests in getting as many deals into escrow as possible in any one period.

Computer power and the right software can eliminate many long-range heartaches on the part of the buyer as well as limiting the opportunities for surreptitious insertions of unfavorable numbers by the broker during the *heat* of calculation. Reducing opportunity is the best way to reduce unscrupulous practices. This program shows you how to accomplish this.

In the software section ahead we move from the serious to the humorous with Ashok Nagrani's COMPUTERIZED SPEECH WRITER.

Another happy note is struck by Ray Duncan's application program CROMEMCO DAZZLER GRAPHICS INTERFACE DRIVER. Video displays are quickly becoming an art form of its own. This program enables the reader to develop interesting displays to delight every member of the family, including the cat.

With a new year upon us, the fatigue of celebrations behind and twelve months of activity ahead, the microcomputer user like everyone else must turn thoughts to taxes. Gary O. Young presents a practical software article which helps you compute your Federal and State taxes and to estimate what effect that raise you fought for might have on next year's taxes. TAX CALCULATION PROGRAM is easy to load and fits into less than 3K of memory. Its companion THE TAX MAN is a game by the same author which introduces an element of entertainment into the wearisome process of tax-paying. The game is based on actual data which may be used in a serious calculation manner. As an education tool for the young, this program cannot be overrated.

In the August issue of INTERFACE AGE we published Elliott Myron's game of CRAZY BALL written in MITS 8K BASIC. Sy Feierstadt rewrote the program for NORTHSTAR DISC BASIC. We hope that NORTHSTAR users will derive as much pleasure from the game as MITS users.

Hopefully those of you who got stuck on the incomplete BIORHYTHM program published in the October issue have now made applicable corrections from the author's revised version which we published in its entirety in the December issue.

Computer(ese) Speech Writer

By Ashok Nagrani

There is a new language that has crept into our society today. You can find it spoken in various walks of corporate life, at the university campuses, and it can sometimes be heard at the local pool halls. The vocabulary used in this language is quite different from anything we have known in the past. Although the language can be written in the Roman script, its sounds, at least to old timers like me, are mostly meaningless.

This language has phrases like "functional monitored mobility" or "synchronized organizational hardware." I guess I could make some meaning out of "optical organizational capacity," but "balanced incremental programming" isn't something they taught me at St. Andrew's High! Being readers of INTERFACE AGE you are perhaps acquainted with this language. Phrases like the above may even be the main ingredients of your speech menu, with a few RAMs and ROMs thrown in for extra measure. But to a mechanical engineer from the Old Country, (That's anywhere beyond the continental shelf!) this new language leaves me confused, befuddled and feeling very, very ignorant. Last week, after sitting through a meeting at Ye Ole Sweat Shoppe, Inc. (my domain from 8 to 5) and listening to an aging computer man (he's 26) say "Group Technology in conjunction with CADAM and Robotics will give management the balanced flexible monitoring that heretobefore (sic) was functionally not optional but none the less a synchronized management concept . . .", I knew I had to do something to become educated in a hurry.

I went to the Company's computer center and looked around to see if I could find someone who spoke English who would enlighten me. After a rather long search, I finally found this weird non-conformist young man. He was the only one in that crowd who didn't have a beard and wasn't smoking a pipe. But what really set him apart from the crowd, though, was that he was not staring at the ceiling or trying to make a meal out of the end of his pencil. I stated my quest to him and asked him if he could help. "Sure," he said, "everyone knows that in order to function in this day and age, you have to know Computerese!"

I soon found out, however, that knowing what my goal was didn't necessarily mean a thing. Nowhere in the library could I find any book on Computerese. I even called Berlitz, but I was no closer to learning Computerese than I was in getting a date with Farrah Fawcett-Majors. So back I went to this cultural throwback at the computer center (the one without beard or pipe) and told him of my plight. Mr. Weird's new pronouncement was even more profound. "Everyone knows that the only way to learn Computerese is to work with the computer experts and learn from them. This knowledge can only be acquired after years and years of service." That sort of thing I had heard from the teachers of meditation who offered unique psychic pleasures in exchange for a lifetime of servitude, but to have to pay that price just to learn a language did seem a little much.

Being a believer in the self-help philosophy, I began to closely analyze what these computer experts were saying, and how they were structuring their speeches and reports. The first revelation was, it does not matter what you say as long as you use long sentences with big words. The next revelation was even more startling. Regardless of the subject, use buzz words that nobody understands. This way, people may not understand what you are saying, but at least, no one will disagree. I also discovered that if you pick sentences and words totally at random, it makes for a really good, totally non-controversial report. And most important, let the words "digital," "peripheral," "optimal," "programming," etc., be to your speech what chili peppers are to tamales. Armed with these profound commandments, and feeling very Talmudic about the whole matter, I pondered long and hard to see how I could use this knowledge to benefit mankind. I am an old believer in that if you can't beat them and they will not let you join them, then ridicule them. That is how SPREG came into being.

SPREG stands for Speech and Report Generator. It is a computer program written in extended BASIC to run on a micro which will help non-Computerese-speaking people like me write reports which sound very learned. All you do is tell the computer the subject of your report and the number of paragraphs you want it to generate for you. The trusted microcomputer does the rest.

The program will give you over a trillion different sentences without ever repeating itself. Of course, a very close analysis of the report may cause you to wonder what it is that the report is trying to say. However, you will admit that such a reaction is very akin to the one shared by many people on reading most of our status reports.

The language of the reports generated is pure Computerese, and the grammar is perfect. Well, maybe not perfect, since it cannot tell when to use "an" instead of "a," but then, *like* they said in the cigarette advertisement, what would you rather have, good Computerese or good grammar?

SPREG is written in Altair's extended BASIC version 3.2. The program requires 16K of RAM for it to function.

Five sentence structures are called up at random. In each of these sentences, the subject, the verb, the adjective, adverbs and objects are again subject to random call. As a result, there are 10^{13} different sentences that result for sentence structure #, 10^3, 10^5, 10^5 and 10^4 different sentences for sentence structure #2, #3, #4 and #5, respectively. Each paragraph comprises three sentences. Hence it is possible to have over 10^{14} different combinations of sentences to form each paragraph.

The program has a built-in safeguard where two identical sentences will not be used in the same paragraph.

SAMPLE PARAGRAPHS

The program generates automatically a report or speech for any length and any occasion. All you need to do is to input the length of the report desired and the subject of the report. The program will make the text available to you freeing you for other important managerial tasks.

```
INPUT SPEECH LENGTH IN MINUTES OR # PARAS IN REPORT
?2
INPUT SUBJECT OF REPORT
? DIGITAL HINDSIGHT

                    DIGITAL HINDSIGHT
  U-CAM ARGUMENTS ARE OPTICAL DIGITAL PROJECTION. WE ARE
CREATING THE REQUIRED DATA BASE DUE TO A COMPATIBLE
TRANSITIONAL CONCEPT. INSPITE OF THE WIDELY-HELD BELIEF
THAT PARALLEL POLICY OPTION USED TO BE CREATING THE
NECESSARY TECHNICAL BACKSTOPS BUT SYSTEMATIZED INCRE-
MENTAL CONCEPT WILL ALLEVIATE OPTICAL THIRD GENERATION
MOBILITY.
  DIGITAL HINDSIGHT HAS NOT CAUSED A INTERACTIVE ALTER-
```

NATE. ROBOTICS ARGUMENTS ARE SYSTEMATIZED ORGANIZATIONAL MOBILITY. ROM WILL FUNCTION AS A OPTIMAL CONSIDERATION BECAUSE OF SYSTEMATIZED LOGIC TIME PHASE.

THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR DIGITAL HINDSIGHT

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? YES
INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT
? 1
INPUT SUBJECT OF REPORT
? COMPUTER MAKEBELIEVE

COMPUTER MAKEBELIEVE

I-CAM WILL ALLEVIATE A INTERPRETIVE ARGUMENT BECAUSE OF SYSTEMATIZED DIGITAL MOBILITY. DUE TO TECHNICAL REASONS SYSTEMATIZED MONITORED PROJECTION CONFIGURED ITSELF AROUND MAKING FANTASTIC PROGRESS BUT SYSTEMATIZED MONITORED PROGRAMMING WILL REQUIRE PARALLEL INCREMENTAL CAPACITY. ROM OPTIONS ARE COMPATIBLE MONITORED CONTINGENCY.

THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR COMPUTER MAKEBELIEVE

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? YES
INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT
? 3
INPUT SUBJECT OF REPORT
? RANDOM PROJECTIONS

RANDOM PROJECTIONS

INSPITE OF THE FACT THAT SYNCHRONIZED POLICY HARDWARE WAS GENERALLY NOT GEARED TO MAKING FANTASTIC PROGRESS BUT FUNCTIONAL MANAGEMENT CONCEPT WILL CAUSE COMPATIBLE LOGIC OPTION. UPPER MANAGEMENT IS RESOLVING PERIPHERAL PROBLEMS DUE TO A TOTAL POLICY OPTION. CAM-I-CAPP VARIABLES ARE PARALLEL INCREMENTAL CAPACITY.

CADAM ENGINEERING AIDS ARE SYSTEMATIZED ORGANIZATIONAL FLEXIBILITY. BECAUSE OF UNFORSEEABLE CIRCUMSTANCES COMPATIBLE TRANSITIONAL FLEXIBILITY WAS GENERALLY NOT GEARED TO GENERATING MANAGEMENT ATTENTION BUT OPTICAL RECIPROCAL PROGRAMMING WILL REQUIRE BALANCED LOGIC MOBILITY. COMPETITION IS CREATING THE NECESSARY TECHNICAL BACKSTOPS DUE TO A OPTICAL THIRD GENERATION PROJECTION.

BECAUSE OF THE FACT THAT PARALLEL MONITORED CONTINGENCY WAS GENERALLY NOT GEARED TO MAKING FANTASTIC PROGRESS BUT RESPONSIVE RECIPROCAL CONTINGENCY WILL ALLEVIATE SYSTEMATIZED TRANSITIONAL PROGRAMMING. OUR INNOVATIVE APPROACH IS CREATING THE NECESSARY TECHNICAL BACKSTOPS DUE TO A BALANCED THIRD GENERATION PROJECTION. RANDOM PROJECTIONS WILL NOT REMAIN A OPTIMAL CONCLUSION.

THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR RANDOM PROJECTIONS

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? YES
INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT
? 2
INPUT SUBJECT OF REPORT
? ORTHOGONAL DESIGNING

ORTHOGONAL DESIGNING

WHILE FUNCTIONAL MANAGEMENT ORTION CONCERNED ITSELF WITH GENERATING MANAGEMENT ATTENTION BUT RESPONSIVE ORGANIZATIONAL PROJECTION WILL PROVE SYNCHRONIZED ORGANIZATIONAL FLEXIBILITY. ORTHOGONAL DESIGNING IS A VIABLE ARGUMENT. ROM WILL PROVE A MANAGEMENT VARIABLE BECAUSE OF INTEGRATED MANAGEMENT CAPACITY.

CADAM WILL CAUSE A OPTIMAL RECOGNITION BECAUSE OF FUNCTIONAL LOGIC MOBILITY. ORTHOGONAL DESIGNING WILL NOT REMAIN A ANALOGOUS SOLUTION. R2-D2 ARGUMENTS ARE TOTAL POLICY HARDWARE.

THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR ORTHOGONAL DESIGNING

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? OVER
HOPE YOU WERE SATISFIED.
GOODBYE

OK

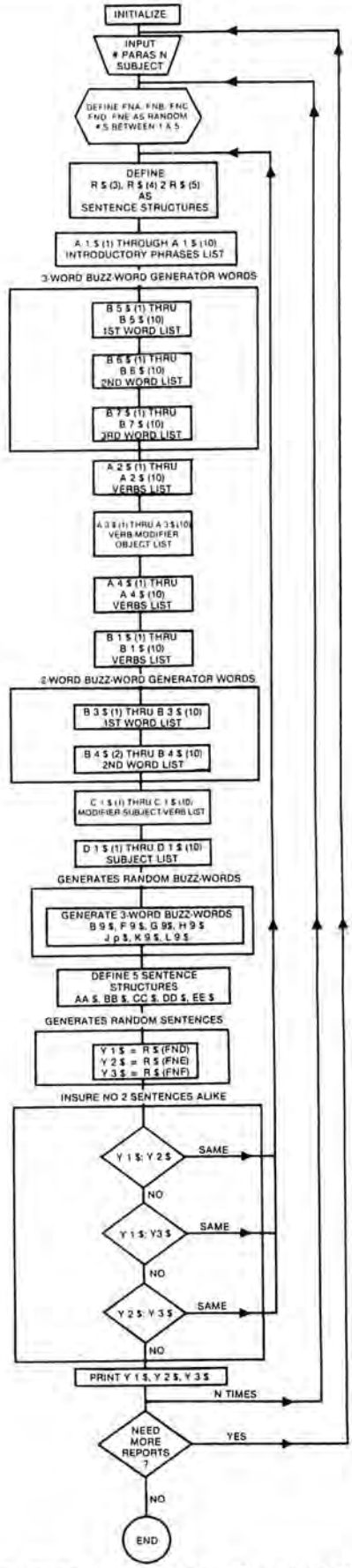


Figure 1. Speech and Report Generator "SPREG" Flow Chart

```
OK
RUN
********** S P R E G R **********************

PROGRAM GENERATES AUTOMATICALLY A REPORT OR SPEECH
FOR ANY LENGTH AND ANY OCCASION.


ALL YOU NEED TO DO IS TO INPUT THE LENGTH OF THE
REPORT DESIRED AND THE SUBJECT OF THE REPORT


THE PROGRAM WILL MAKE THE TEXT AVAILABLE TO YOU
FREEING YOU FOR OTHER IMPORTANT MANAGERIAL TASKS.


INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT
? 1
INPUT SUBJECT OF REPORT
? MANUFACTURING SCHEDULES

                    MANUFACTURING SCHEDULES
ALTHOUGH PARALLEL RECIPROCAL FLEXIBILITY DID NOT CONCERN ITSELF WITH CRE
ATING REQUIRED AWARENESS BUT TOTAL TRANSITIONAL TIME PHASE WILL COMPLEME
NT SYSTEMATIZED INCREMENTAL TIME PHASE . MANUFACTURING SCHEDULES IS LIKE
LY TO BE A OPTIMAL ARGUMENT . OUR INNOVATIVE APPROACH IS CREATING THE NE
CESSARY TECHNICAL BACKSTOPS DUE TO A RESPONSIVE RECIPROCAL MOBILITY .



THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR MANUFACTURING SCHEDULES

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? YES
INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT
? 2
INPUT SUBJECT OF REPORT
? RESEARCH PROGRAMS

                    RESEARCH PROGRAMS
CADAM PATTERNS ARE FUNCTIONAL TRANSITIONAL OPTION . WHILE FUNCTIONAL POL
ICY HARDWARE USED TO BE CREATING THE NECESSARY TECHNICAL BACKSTOPS BUT T
OTAL RECIPROCAL FLEXIBILITY WILL SUPPORT PARALLEL MONITORED MOBILITY , R
ECENT TECHNOLOGICAL ADVANCES ARE FORMULATING SPECIFIC PLANS DUE TO A TOT
AL DIGITAL CONCEPT .

U-CAM ARGUMENTS ARE OPTICAL DIGITAL PROJECTION . WE ARE CREATING THE REQ
UIRED DATA BASE DUE TO A COMPATABLE TRANSITIONAL CONCEPT . INSPITE OF TH
E WIDELY HELD BELIEF THAT PARALLEL POLICY OPTION USED TO BE CREATING THE
 NECESSARY TECHNICAL BACKSTOPS BUT SYSTEMATIZED INCREMENTAL CONCEPT WILL
 ALLEVIATE OPTICAL THIRD GENERATION MOBILITY .



THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR RESEARCH PROGRAMS

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? YES
INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT
? 3
INPUT SUBJECT OF REPORT
? AUTOMATIC REPORTING

                    AUTOMATIC REPORTING
RESEARCH PROGRAMS HAS NOT CAUSED A INTERACTIVE ALTERNATE . ROBOTICS ARGU
MENTS ARE SYSTEMATIZED ORGANIZATIONAL MOBILITY . ROM WILL FUNCTION AS A
OPTIMAL CONSIDERATION BECAUSE OF SYSTEMATIZED LOGIC TIME PHASE .

I-CAM WILL ALLEVIATE A INTERPRETIVE ARGUMENT BECAUSE OF SYSTEMATIZED DIG
ITAL MOBILITY . DUE TO TECHNICAL REASONS SYSTEMATIZED MONITORED PROJECTI
ON CONFIGURED ITSELF AROUND MAKING FANTASTIC PROGRESS BUT SYSTEMATIZED M
ONITORED PROGRAMMING WILL REQUIRE PARALLEL INCREMENTAL CAPACITY . ROM OP
TIONS ARE COMPATABLE MONITORED CONTINGENCY .

INSPITE OF THE FACT THAT SYNCHRONIZED POLICY HARDWARE WAS GENERALLY NOT
GEARED TO MAKING FANTASTIC PROGRESS BUT FUNCTIONAL MANAGEMENT CONCEPT WI
LL CAUSE COMPATABLE LOGIC OPTION . UPPER MANAGEMENT IS RESOLVING PERIPHE
RAL PROBLEMS DUE TO A TOTAL POLICY OPTION . CAM-I-CAPP VARIABLES ARE PAR
ALLEL INCREMENTAL CAPACITY .



THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED
FOR AUTOMATIC REPORTING

DO YOU NEED ANY MORE REPORTS?
TYPE-YES, OTHERWISE TYPE-OVER
? OVER
HOPE YOU WERE SATISFIED.
      GOODBYE

OK



LIST

10 CLEAR 10000
100 PRINT"********** S P R E G R **********************
105 PRINT
110 PRINT
115 PRINT"PROGRAM GENERATES AUTOMATICALLY A REPORT OR SPEECH"
120 PRINT"FOR ANY LENGTH AND ANY OCCASION."
125 PRINT
130 PRINT
135 PRINT"ALL YOU NEED TO DO IS TO INPUT THE LENGTH OF THE "
140 PRINT"REPORT DESIRED AND THE SUBJECT OF THE REPORT"
145 FOR I=1 TO 1200:NEXT I
150 PRINT
155 PRINT
160 PRINT"THE PROGRAM WILL MAKE THE TEXT AVAILABLE TO YOU"
165 PRINT"FREEING YOU FOR OTHER IMPORTANT MANAGERIAL TASKS."
170 FOR I=1 TO 600:NEXT I
180 PRINT
190 PRINT
200 PRINT"INPUT SPEECH LENGTH IN MINUTES OR # OF PARAS IN REPORT"
210 INPUT X
220 PRINT"INPUT SUBJECT OF REPORT"
230 INPUT K$
240 IF K$="0" THEN GOTO 230
241 PRINT
242 PRINT TAB(20), K$
245 FOR I=1 TO X
250 DEF FNA=INT(10*RND(1)+1)
255 DEF FNB=INT(10*RND(1)+1)
260 DEF FNC=INT(10*RND(1)+1)
265 DEF FND=INT(5*RND(1)+1)
270 DEF FNE=INT(5*RND(1)+1)
275 DEF FNF=INT(5*RND(1)+1)
600 R$(1)=AA$
610 R$(2)=BB$
620 R$(3)=CC$
630 R$(4)=DD$
640 R$(5)=EE$
700 REM A1$ SUBROUTINE
705 A1$(1)="ALTHOUGH "
710 A1$(2)="IN THE PAST "
715 A1$(3)="PER PAST PRACTICE "
720 A1$(4)="SINCE "
725 A1$(5)="WHILE "
730 A1$(6)="INSPITE OF THE FACT THAT "
735 A1$(7)="INSPITE OF THE WIDELY HELD BELIEF THAT "
740 A1$(8)="DUE TO TECHNICAL REASONS "
745 A1$(9)="BECAUSE OF THE FACT THAT "
750 A1$(10)="BECAUSE OF UNFORSEABLE CIRCUMSTANCES "
800 REM B2$ SUBROUTINE
805 B5$(1)="INTEGRATED "
810 B5$(2)="TOTAL "
815 B5$(3)="SYSTEMATIZED "
820 B5$(4)="PARALLEL "
825 B5$(5)="FUNCTIONAL "
830 B5$(6)="OPTICAL "
835 B5$(7)="SYNCHRONIZED "
840 B5$(8)="COMPATABLE "
845 B5$(9)="BALANCED "
850 B5$(10)="RESPONSIVE "
855 B6$(1)="MANAGEMENT "
860 B6$(2)="ORGANIZATIONAL "
865 B6$(3)="MONITORED "
870 B6$(4)="RECIPROCAL "
875 B6$(5)="DIGITAL "
880 B6$(6)="LOGIC "
885 B6$(7)="TRANSITIONAL "
890 B6$(8)="INCREMENTAL "
895 B6$(9)="THIRD GENERATION "
900 B6$(10)="POLICY "
905 B7$(1)="OPTION "
910 B7$(2)="FLEXIBILITY "
915 B7$(3)="CAPACITY "
920 B7$(4)="MOBILITY "
925 B7$(5)="PROGRAMMING "
930 B7$(6)="CONCEPT "
935 B7$(7)="TIME PHASE "
940 B7$(8)="PROJECTION "
945 B7$(9)="HARDWARE "
950 B7$(10)="CONTINGENCY "
956 A2$(1)="HAS BEEN "
960 A2$(2)="USED TO BE "
965 A2$(3)="WAS GENERALLY GEARED TO "
970 A2$(4)="CONCERNED ITSELF WITH "
975 A2$(5)="CONFIGURED ITSELF AROUND "
980 A2$(6)="HAS NOT BEEN "
985 A2$(7)="DID NOT CONCERN ITSELF WITH "
990 A2$(8)="WAS GENERALLY NOT GEARED TO "
995 A2$(9)="WAS TEMPORARILY INEFFECTIVE IN "
1000 A2$(10)="FINDS ITSELF "
1001 REM A3$ SUBROUTINE
1005 A3$(1)="ADVANCING THE STATE OF THE ART "
1010 A3$(3)="LOWERING THE LEARNING CURVE "
1015 A3$(2)="MAKING FANTASTIC PROGRESS "
1020 A3$(4)="GENERATING MANAGEMENT ATTENTION "
1025 A3$(5)="CREATING REQUIRED AWARENESS "
1030 A3$(6)="CREATING THE REQUIRED DATA BASE "
1035 A3$(7)="RESOLVING PERIPHERAL PROBLEMS "
1040 A3$(8)="CREATING THE NECESSARY TECHNICAL BACKSTOPS "
1045 A3$(9)="RAISING THE LEVEL OF MANAGEMENT CONSCIOUSNESS
1050 A3$(10)="FORMULATING SPECIFIC PLANS "
1051 REM A4$ SUBROUTINE
1055 A4$(1)="WILL FUNCTION AS "
1060 A4$(2)="WILL NOT FUNCTION AS "
1065 A4$(3)="WILL CAUSE "
1070 A4$(4)="WILL REQUIRE "
1075 A4$(5)="WILL NEGATE "
1080 A4$(6)="WILL PROVE "
1085 A4$(7)="WILL SUPPORT "
1090 A4$(8)="WILL COMPLEMENT "
1095 A4$(9)="WILL SUPPLEMENT "
1100 A4$(10)="WILL ALLEVIATE "
1101 REM B1$ SUBROUTINE
1105 B1$(1)="IS A "
1110 B1$(2)="IS NOT A "
1115 B1$(3)="IS LIKELY TO BE A "
1120 B1$(4)="WILL NOT PROVE TO BE A "
1125 B1$(5)="REMAINS A "
1130 B1$(6)="HAS CAUSED A "
1135 B1$(7)="HAS NOT CAUSED A "
1140 B1$(8)="CAN AT SOME TIME BECOME "
1145 B1$(9)="WILL NOT REMAIN A "
1150 B1$(10)="CANNOT BECOME A "
1151 REM B3$ SUBROUTINE
1155 B3$(1)="VIABLE "
1160 B3$(2)="RESPONSIVE "
1165 B3$(3)="FEASIBLE "
1170 B3$(4)="OPTIMAL "
1175 B3$(5)="MANAGEMENT "
1180 B3$(6)="TECHNICAL "
1185 B3$(7)="ANALOGOUS "
1190 B3$(8)="INTERACTIVE "
1195 B3$(9)="INTERPRETIVE "
1200 B3$(10)="EARLY "
1201 REM B4$ SUBROUTINE
1205 B4$(1)="ALTERNATE "
1210 B4$(2)="SOLUTION "
1215 B4$(3)="RECOGNITION "
1220 B4$(4)="VARIABLE "
1222 B4$(5)="OPTION "
1230 B4$(6)="CONSIDERATION "
1235 B4$(7)="CONCLUSION "
1240 B4$(8)="PATTERN "
1245 B4$(9)="ARGUMENT "
1250 B4$(10)="CONCEPT "
1251 REM C1$ SUBROUTINE
1255 C1$(1)="WE ARE "
1260 C1$(2)="COMPETITION IS "
1265 C1$(3)="INDUSTRY TRENDS ARE
```

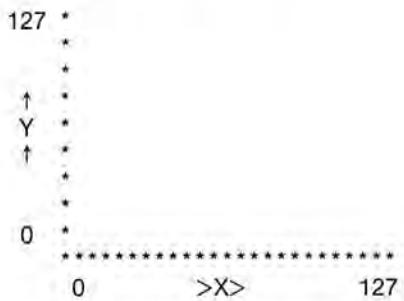
Branched to Page 175

Cromemco Dazzler Graphics Interface Driver

By Ray Duncan

This driver runs on the Intel 8080 microprocessor. It allows for software character generation or point-by-point control of the video display. The Dazzler board is used in the high resolution black and white mode requiring a 2K memory buffer.

The driver treats the dazzler display as a 128-high by 128-wide matrix:



Six user services are provided. The jump links located at E03F in this version can be relocated to guaranteed locations in your monitor for use by application programs.

"DZON" : passes buffer address to controller and turns on display.

"DZOFF" : turns video display off, does not alter the contents of video memory buffer.

"DZZ" : clears the video memory buffer.

"DZP" : sets selected point in matrix on or off.

Call with A = 0 to turn point off
A = 1 to turn point on
B = X coordinate (0-127)
C = Y coordinate (0-127)
Exits with registers HL, BC, DE preserved register A and flags unpredictable

"DZL" : display ASCII character string. In this mode display is divided into 18 lines.

Call with A = line number (0-17)
HL = first byte address of output character string. String must end with OD (car. ret.).

"DZC" : display ASCII character.

Call with A = ASCII char code
B = X coordinate (0-127) for upper left corner of char
C = Y coordinate (0-127) for upper left corner of char
Returns registers B, C containing updated X, Y for next char. to be displayed. That is, register C is returned unchanged and register B is offset to the right by the width + of the char just displayed.

Program Tables:

"DZLA" : used by "DZL" routine to set the Y coordinate (0-127) for a given line number (0-17).

"DZTAB" : contains the bit patterns used to generate characters on the display. Each ASCII character has six bytes:

Byte 0 contains the width in dot rows of character
Byte 1 contains pattern for top dot row of character
Byte 2 contains pattern for 2nd dot row of character
Bytes 3-5 etc.

This table can be easily expanded or modified by the user to allow for special character sets.

PROGRAM LISTING

```
                        ;
                        ; DRIVER FOR CROMEMCO DAZZLER GRAPHICS INTERFACE
                        ;
                        ; WRITTEN BY RAY DUNCAN
                        ;            17424 BURBANK, APT 110
                        ;            ENCINO, CA. 91316
                        ;
                        ;
F800                    FLOS EQU 0F800H ;LINK TO OPERATING SYSTEM
F800                    DZBUF EQU 0F800H ;DAZZLER GRAPHICS DMA BUFFER
                        ;
E03F                     ORG 0E03FH ;LINKS TO SERVICES
E03F C30EE8             JMP DZZ     ;CLEAR DISPLAY
E042 C324E8             JMP DZP     ;SET/CLEAR POINT
E045 C3A0E6             JMP DZL  ; ALPHANUMERIC LINE
E048 C3CFE8             JMP DZC  ; ALPHA NUMERIC CHAR
E04B C300E8             JMP DZON ;TURN DISPLAY ON
E04E C309E8             JMP DZOFF ;TURN DISPLAY OFF
                        ;
E800                     ORG 0E800H
                        ;
                        DZON:   ;TURN DAZZLER DISPLAY ON
E800 3EFC                MVI A,DZBUF SHR 9 + 80H
E802 D30E                OUT 14
E804 3E68                MVI A,68H
E806 D30F                OUT 15
E808 C9                  RET
                        ;
                        DZOFF:   ;TURN DAZZLER DISPLAY OFF
E809 3E00                MVI A,0
E80B D30E                OUT 14
E80D C9                  RET
                        ;
                        ;
                        DZZ:            ;CLEAR DAZZLER DISPLAY
E80E CD09E8              CALL DZOFF
E811 2100F8              LXI H,DZBUF
E814 110008              LXI D,2048
E817 3600               DZZ1: MVI M,0
E819 23                  INX H
E81A 1B                  DCX D
E81B 7B                  MOV A,E
E81C B2                  ORA D
E81D C217E8              JNZ DZZ1
E820 CD00E8              CALL DZON
E823 C9                  RET
                        ;
                        ;
                        ; SET DAZZLER DISPLAY POINT ON/OFF
                        ;
                        ; DISPLAY IS ASSUMED TO BE 128 X 128 POINT MATRIX
                        ; IN RESOLUTION X 4 MODE
                        ;
                        ; CALL WITH A=0  => TURN POINT OFF
                        ; CALL WITH A=1  => TURN POINT ON
                        ; REG B= X (0-127)
                        ; REG C= Y (0-127)
                        ;
                        DZP:
E824 E5                  PUSH H
E825 D5                  PUSH D
E826 C5                  PUSH B
E827 F5                  PUSH PSW
E828 3E7F                MVI A,127
E82A 91                  SUB C
E82B 4F                  MOV C,A
E82C 2100F8              LXI H,DZBUF ;CALC BASE ADDR OF QUADRANT
E82F 110002              LXI D,512
E832 78                  MOV A,B ;X AXIS
E833 FE40                CPI 64
E835 FA3CE8              JM DZP1 ;IN LEFT HALF, JUMP
E838 D640                SUI 64
E83A 47                  MOV B,A
E83B 19                  DAD D   ;BUMP BUFFER BASE
E83C 79                 DZP1: MOV A,C ;Y AXIS
E83D FE40                CPI 64
E83F FA47E8              JM DZP15 ;IN LOWER HALF, JUMP
```

```
E842 D640       SUI 64
E844 4F         MOV C,A
E845 19         DAD D ;BUMP BUFFER BASE
E846 19         DAD D
                        ;NOW HAVE HL=BASE ADDR OF 512 BYTE QUADRANT
                        ;B=X(0-63),C=Y(0-63)
E847 1600       DZP15: MVI D,0 ;DIVIDE X BY 4 AND ADD TO BASE
E849 78          MOV A,B
E84A OF          RRC
E84B OF          RRC
E84C E60F        ANI OFH
E84E 5F          MOV E,A
E84F 19          DAD D
E850 79          MOV A,C ;ADD ((Y/2)*16) TO BUFFER BASE
E851 OF          RRC
E852 E61F        ANI 1FH
E854 5F          MOV E,A
                 ;
                 RDEL    MACRO
                         MOV A,E
                         RAL
                         MOV E,A
                         MOV A,D
                         RAL
                         MOV D,A
                         ENDM

                 RDEL ;DE*16
E855 7B                  MOV A,E
E856 17                  RAL
E857 5F                  MOV E,A
E858 7A                  MOV A,D
E859 17                  RAL
E85A 57                  MOV D,A

                 RDEL
E85B 7B                  MOV A,E
E85C 17                  RAL
E85D 5F                  MOV E,A
E85E 7A                  MOV A,D
E85F 17                  RAL
E860 57                  MOV D,A

                 RDEL
E861 7B                  MOV A,E
E862 17                  RAL
E863 5F                  MOV E,A
E864 7A                  MOV A,D
E865 17                  RAL
E866 57                  MOV D,A

                 RDEL
E867 7B                  MOV A,E
E868 17                  RAL
E869 5F                  MOV E,A
E86A 7A                  MOV A,D
E86B 17                  RAL
E86C 57                  MOV D,A

E86D 19          DAD D
E86E E5          PUSH H ;SAVE BYTE ADDR BUFFER
E86F 2198E8      LXI H,DZPA ;CALC OFFSET INTO BIT MAP TABLE
E872 79          MOV A,C  ;FETCH Y
E873 E601        ANI 1    ;EVEN OR ODD LINE?
E875 CA7BE8      JZ DZP35 ;EVEN, JUMP
E878 219CE8      LXI H,DZPA+4
E87B 78         DZP35: MOV A,B  ;X COORDINATE
E87C E603        ANI 3H ;ISOLATE 0-3 RELATIVE
E87E 1600        MVI D,0
E880 5F          MOV E,A
E881 19          DAD D  ;ADD TO TABLE ADDR
E882 56          MOV D,M ;FETCH BIT MAP FROM TABLE
E883 E1          POP H ;RESTORE MATRIX BYTE ADDR
E884 F1          POP PSW ;FETCH ON/OFF FLAG
E885 E601        ANI 1
E887 CA90E8      JZ DZP5 ;JUMP IF OFF
E88A 7E         DZP4: MOV A,M ;TURN BIT ON
E88B B2          ORA D
E88C 77          MOV M,A
E88D C394E8      JMP DZP6
E890 7A         DZP5: MOV A,D ;TURN BIT OFF
E891 2F          CMA ;FLOP BITS
E892 A6          ANA M ;MASK MEMORY
E893 77          MOV M,A ;STORE BACK INTO BUFFER
E894 C1         DZP6: POP B
E895 D1          POP D
E896 E1          POP H
E897 C9          RET
                 ;
                 DZPA:           ;BIT MAP
                                 ; IN RESOLUTION X 4 MODE,
                                 ; ONE BYTE OF MEMORY IS USED
                                 ; TO DISPLAY 8 ADJACENT POINTS
                                 ;
                                 ;       REL  X=0  X=1  X=2  X=3
                                 ;
                                 ;Y EVEN        D0   D1   D4   D5
                                 ;Y ODD         D2   D3   D6   D7
E898 01                  DB 00000001B
E899 02                  DB 00000010B
E89A 10                  DB 00010000B
E89B 20                  DB 00100000B
E89C 04                  DB 00000100B
E89D 08                  DB 00001000B
E89E 40                  DB 01000000B
E89F 80                  DB 10000000B
                 ;
                 ;
                 ; DISPLAY ASCII CHAR STRING
                 ; CALL A= LINE NUMBER (0-17)
                 ;       HL=FBA CHAR STRING
                 ; STRING MUST END WITH ODH
E8A0 E5         DZL: PUSH H ;SAVE FBA STRING
E8A1 010000      LXI B,0 ;CALC TABLE ADDR FOR Y COORD
E8A4 FE12        CPI 18
E8A6 F2AAE8      JP DZL1 ;LINE NUMBER TOO LARGE
E8A9 4F          MOV C,A
E8AA 21BDE8     DZL1: LXI H,DZLA
E8AD 09          DAD B
E8AE 4E          MOV C,M ;FETCH Y COORD
E8AF E1          POP H ;RESTORE FBA STRING
E8B0 7E         DZL2: MOV A,M
E8B1 FE0D        CPI ODH ;DONE YET?
E8B3 C8          RZ ;YES, BACK TO CALLER
E8B4 E5          PUSH H
E8B5 CDCFE8      CALL DZC ;DISPLAY THIS CHAR
E8B8 E1          POP H
E8B9 23          INX H
E8BA C3B0E8      JMP DZL2
                 ;
                 ;       THIS TABLE GIVES Y COORDINATE
                 ;       FOR UPPER DOT ROW OF
                 ;       CHARACTER LINES 0-17
E8BD 7B         DZLA: DB 123 ; LINE 0
E8BE 74          DB 116 ; 1
E8BF 6D          DB 109 ; 2
E8C0 66          DB 102 ; 3
E8C1 5F          DB 95 ; 4
E8C2 58          DB 88 ; 5
E8C3 51          DB 81 ; 6
E8C4 4A          DB 74 ; 7
E8C5 43          DB 67 ; 8
E8C6 3C          DB 60 ; 9
E8C7 35          DB 53 ; 10
E8C8 2E          DB 46 ; 11
E8C9 27          DB 39 ; 12
E8CA 20          DB 32 ; 13
E8CB 19          DB 25 ; 14
E8CC 12          DB 18 ; 15
E8CD 0B          DB 11 ; 16
E8CE 04          DB 4 ; 17
                 ;
                 ;
                 ;
                 ;
                 ; DISPLAY ONE ASCII CHAR
                 ; CALL WITH A=ASCII CHAR
                 ;           B,C = X,Y COORD FOR
                 ;                 UPPER LEFT CORNER OF CHAR.
                 ; RETURNS UPDATED X,Y FOR NEXT CHAR IN B,C
                 ; USES D FOR SCAN ROW COUNT, HL FOR BIT TABLE ADDR
E8CF CDF7E8     DZC: CALL DZC5 ; CALC BIT TABLE ADDR
E8D2 C5          PUSH B
E8D3 56          MOV D,M ;GET CHAR SCAN LINE WIDTH
E8D4 23          INX H
E8D5 7E          MOV A,M
E8D6 CD10E9      CALL DZC6 ;ROW 0
E8D9 23          INX H
E8DA 0D          DCR C
E8DB 7E          MOV A,M
E8DC CD10E9      CALL DZC6 ;ROW 1
E8DF 23          INX H
E8E0 0D          DCR C
E8E1 7E          MOV A,M
E8E2 CD10E9      CALL DZC6 ;ROW 2
E8E5 23          INX H
E8E6 0D          DCR C
E8E7 7E          MOV A,M
E8E8 CD10E9      CALL DZC6 ;ROW 3
E8EB 23          INX H
E8EC 0D          DCR C
E8ED 7E          MOV A,M
E8EE CD10E9      CALL DZC6 ;ROW 4
E8F1 C1          POP B ;ORIG X,Y COORDINATES
E8F2 7A           MOV A,D
E8F3 80          ADD B ;UPDATE X FOR NEXT CHAR
E8F4 47          MOV B,A
E8F5 04          INR B
E8F6 C9          RET
                 ;
                 ; CALC BIT TABLE ADDR FOR GIVEN CHAR
                 ; CALL A=ASCII CHAR
                 ; RETURN HL=TABLE ADDR
E8F7 D5         DZC5: PUSH D
E8F8 2121E9      LXI H,DZTAB
                                 ; ADD ASCII CODE * 6
                                 ;  TO BASE ADDRESS OF TABLE

E8FB E67F        ANI 7FH
E8FD 5F          MOV E,A
E8FE 1600        MVI D,0
                 RDEL    ; DE*2
E900 7B                  MOV A,E
E901 17                  RAL
E902 5F                  MOV E,A
E903 7A                  MOV A,D
E904 17                  RAL
E905 57                  MOV D,A

E906 19          DAD D
                 RDEL    ;DE*4
E907 7B                  MOV A,E
E908 17                  RAL
E909 5F                  MOV E,A
E90A 7A                  MOV A,D
E90B 17                  RAL
E90C 57                  MOV D,A

E90D 19          DAD D
E90E D1          POP D
E90F C9          RET

                 ;
                 ; DO ONE SCAN ROW
                 ; CALL A=BIT PATTERN
                 ; D= # OF SCAN LINES WIDE
                 ; B,C =X,Y
                 DZC6:
E910 5A           MOV E,D
E911 C5           PUSH B
```

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```
E912 07          DZC61: RLC
E913 F5           PUSH PSW
E914 E601         ANI 1
E916 CD24E8       CALL DZP
E919 F1           POP PSW
E91A 04           INR B
E91B 1D           DCR E ;COUNT SCAN LINES
E91C F212E9       JP DZC61
E91F C1           POP B
E920 C9           RET
                  ;
                  ;
                  DZTAB:
E921               DS 20H*6
E9E1 03           DB 3 ; 20 SPACE
E9E2 00000000     DB 0,0,0,0,0
E9E6 00
E9E7 01           DB 1 ; 21 !
E9E8 80           DB 10000000B
E9E9 80           DB 10000000B
E9EA 80           DB 10000000B
E9EB 00           DB 00000000B
E9EC 80           DB 10000000B
E9ED 03           DB 3 ; 22 "
E9EE A0           DB 10100000B
E9EF A0           DB 10100000B
E9F0 00           DB 0
E9F1 00           DB 0
E9F2 00           DB 0
E9F3 05           DB 5 ; 23 #
E9F4 50           DB 01010000B
E9F5 F8           DB 11111000B
E9F6 50           DB 01010000B
E9F7 F8           DB 11111000B
E9F8 50           DB 01010000B
E9F9 05           DB 5 ; 24 $
E9FA F8           DB 11111000B
E9FB A0           DB 10100000B
E9FC F8           DB 11111000B
E9FD 28           DB 00101000B
E9FE F8           DB 11111000B
E9FF 05           DB 5 ; 25 %
EA00 08           DB 00001000B
EA01 90           DB 10010000B
EA02 20           DB 00100000B
EA03 48           DB 01001000B
EA04 80           DB 10000000B
EA05 04           DB 4 ; 26 &
EA06 C0           DB 11000000B
EA07 A0           DB 10100000B
EA08 40           DB 01000000B
EA09 A0           DB 10100000B
EA0A D0           DB 11010000B
EA0B 02           DB 2 ; 27 '
EA0C 40           DB 01000000B
EA0D 80           DB 10000000B
EA0E 00           DB 0
EA0F 00           DB 0
EA10 00           DB 0
EA11 02           DB 2 ; 28 (
EA12 40           DB 01000000B
EA13 80           DB 10000000B
EA14 80           DB 10000000B
EA15 80           DB 10000000B
EA16 40           DB 01000000B
EA17 02           DB 2 ; 29 )
EA18 80           DB 10000000B
EA19 40           DB 01000000B
EA1A 40           DB 01000000B
EA1B 40           DB 01000000B
EA1C 80           DB 10000000B
EA1D 05           DB 5 ; 2A *
EA1E 20           DB 00100000B
EA1F 50           DB 01010000B
EA20 A8           DB 10101000B
EA21 50           DB 01010000B
EA22 20           DB 00100000B
EA23 03           DB 3 ; 2B +
EA24 00           DB 0
EA25 40           DB 01000000B
EA26 E0           DB 11100000B
EA27 40           DB 01000000B
EA28 00           DB 0
EA29 02           DB 2 ; 2C ,
EA2A 000000       DB 0,0,0
EA2D 40           DB 01000000B
EA2E C0           DB 11000000B
EA2F 03           DB 3 ; 2D -
EA30 0000         DB 0,0
EA32 E0           DB 11100000B
EA33 0000         DB 0,0
EA35 01           DB 1 ; 2E .
EA36 00000000     DB 0,0,0,0,10000000B
EA3A 80
EA3B 05           DB 5 ; 2F /
EA3C 08           DB 00001000B
EA3D 10           DB 00010000B
EA3E 20           DB 00100000B
EA3F 40           DB 01000000B
EA40 80           DB 10000000B
                  ;
EA41 03           DB 3 ; 30 0
EA42 40           DB 01000000B
EA43 A0           DB 10100000B
EA44 A0           DB 10100000B
EA45 A0           DB 10100000B
EA46 40           DB 01000000B
EA47 03           DB 3 ; 31 1
EA48 40           DB 01000000B
EA49 C0           DB 11000000B
EA4A 40           DB 01000000B
EA4B 40           DB 01000000B
EA4C E0           DB 11100000B
EA4D 03           DB 3 ; 32 2
EA4E E0           DB 11100000B
EA4F 20           DB 00100000B
EA50 20           DB 00100000B
EA51 40           DB 01000000B
EA52 E0           DB 11100000B
EA53 03           DB 3 ; 33 3
EA54 E0           DB 11100000B
EA55 20           DB 00100000B
EA56 60           DB 01100000B
EA57 20           DB 00100000B
EA58 E0           DB 11100000B
EA59 03           DB 3 ; 34 4
EA5A A0           DB 10100000B
EA5B A0           DB 10100000B
EA5C E0           DB 11100000B
EA5D 20           DB 00100000B
EA5E 20           DB 00100000B
EA5F 03           DB 3 ; 35 5
EA60 E0           DB 11100000B
EA61 80           DB 10000000B
EA62 C0           DB 11000000B
EA63 20           DB 00100000B
EA64 C0           DB 11000000B
EA65 03           DB 3 ; 36 6
EA66 E0           DB 11100000B
EA67 80           DB 10000000B
EA68 E0           DB 11100000B
EA69 A0           DB 10100000B
EA6A E0           DB 11100000B
EA6B 03           DB 3 ; 37 7
EA6C E0           DB 11100000B
EA6D 20           DB 00100000B
EA6E 40           DB 01000000B
EA6F 80           DB 10000000B
EA70 80           DB 10000000B
EA71 03           DB 3 ; 38 8
EA72 E0           DB 11100000B
EA73 A0           DB 10100000B
EA74 40           DB 01000000B
EA75 A0           DB 10100000B
EA76 E0           DB 11100000B
EA77 03           DB 3 ; 39 9
EA78 E0           DB 11100000B
EA79 A0           DB 10100000B
EA7A E0           DB 11100000B
EA7B 20           DB 00100000B
EA7C 20           DB 00100000B
EA7D 01           DB 1 ; 3A :
EA7E 0000         DB 0,0
EA80 80           DB 10000000B
EA81 00           DB 0
EA82 80           DB 10000000B
EA83 02           DB 2 ; 3B ;
EA84 00           DB 0
EA85 40           DB 01000000B
EA86 00           DB 0
EA87 40           DB 01000000B
EA88 C0           DB 11000000B
EA89 03           DB 3 ; 3C <
EA8A 20           DB 00100000B
EA8B 40           DB 01000000B
EA8C 80           DB 10000000B
EA8D 40           DB 01000000B
EA8E 20           DB 00100000B
EA8F 03           DB 3 ; 3D =
EA90 00           DB 0
EA91 E0           DB 11100000B
EA92 00           DB 0
EA93 E0           DB 11100000B
EA94 00           DB 0
EA95 03           DB 3 ; 3E >
EA96 80           DB 10000000B
EA97 40           DB 01000000B
EA98 20           DB 00100000B
EA99 40           DB 01000000B
EA9A 80           DB 10000000B
EA9B 03           DB 3 ; 3F ?
EA9C E0           DB 11100000B
EA9D 20           DB 00100000B
EA9E 60           DB 01100000B
EA9F 00           DB 0
EAA0 40           DB 01000000B
EAA1 05           DB 5 ;  40 @
EAA2 F8           DB 11111000B
EAA3 80           DB 10000000B
EAA4 B8           DB 10111000B
EAA5 A8           DB 10101000B
EAA6 F8           DB 11111000B
EAA7 03           DB 3 ; 41 A
EAA8 40           DB 01000000B
EAA9 A0           DB 10100000B
EAAA E0           DB 11100000B
EAAB A0           DB 10100000B
EAAC A0           DB 10100000B
EAAD 03           DB 3 ; 42 B
EAAE C0           DB 11000000B
EAAF A0           DB 10100000B
EAB0 C0           DB 11000000B
EAB1 A0           DB 10100000B
EAB2 C0           DB 11000000B
EAB3 03           DB 3 ; 43 C
EAB4 E0           DB 11100000B
EAB5 80           DB 10000000B
EAB6 80           DB 10000000B
EAB7 80           DB 10000000B
EAB8 E0           DB 11100000B
EAB9 03           DB 3 ; 44 D
EABA C0           DB 11000000B
EABB A0           DB 10100000B
EABC A0           DB 10100000B
EABD A0           DB 10100000B
EABE C0           DB 11000000B
EABF 03           DB 3 ; 45 E
EAC0 E0           DB 11100000B
EAC1 80           DB 10000000B
EAC2 C0           DB 11000000B
EAC3 80           DB 10000000B
EAC4 E0           DB 11100000B
EAC5 03           DB 3 ; 46 F
```

```
EAC6 E0         DB 11100000B
EAC7 80         DB 10000000B
EAC8 C0         DB 11000000B
EAC9 80         DB 10000000B
EACA 80         DB 10000000B
EACB 04         DB 4 ; 47 G
EACC F0         DB 11110000B
EACD 80         DB 10000000B
EACE B0         DB 10110000B
EACF 90         DB 10010000B
EAD0 F0         DB 11110000B
EAD1 03         DB 3 ; 48 H
EAD2 A0         DB 10100000B
EAD3 A0         DB 10100000B
EAD4 E0         DB 11100000B
EAD5 A0         DB 10100000B
EAD6 A0         DB 10100000B
EAD7 03         DB 3 ; 49 I
EAD8 E0         DB 11100000B
EAD9 40         DB 01000000B
EADA 40         DB 01000000B
EADB 40         DB 01000000B
EADC E0         DB 11100000B
EADD 03         DB 3 ; 4A J
EADE E0         DB 11100000B
EADF 40         DB 01000000B
EAE0 40         DB 01000000B
EAE1 40         DB 01000000B
EAE2 C0         DB 11000000B
EAE3 04         DB 4 ; 4B K
EAE4 90         DB 10010000B
EAE5 A0         DB 10100000B
EAE6 C0         DB 11000000B
EAE7 A0         DB 10100000B
EAE8 90         DB 10010000B
EAE9 03         DB 3 ; 4C L
EAEA 80         DB 10000000B
EAEB 80         DB 10000000B
EAEC 80         DB 10000000B
EAED 80         DB 10000000B
EAEE E0         DB 11100000B
EAEF 05         DB 5 ; 4D M
EAF0 88         DB 10001000B
EAF1 D8         DB 11011000B
EAF2 A8         DB 10101000B
EAF3 88         DB 10001000B
EAF4 88         DB 10001000B
EAF5 04         DB 4 ; 4E N
EAF6 90         DB 10010000B
EAF7 D0         DB 11010000B
EAF8 B0         DB 10110000B
EAF9 90         DB 10010000B
EAFA 90         DB 10010000B
EAFB 03         DB 3 ; 4F O
EAFC E0         DB 11100000B
EAFD A0         DB 10100000B
EAFE A0         DB 10100000B
EAFF A0         DB 10100000B
EB00 E0         DB 11100000B
EB01 03         DB 3 ; 50 P
EB02 C0         DB 11000000B
EB03 A0         DB 10100000B
EB04 C0         DB 11000000B
EB05 80         DB 10000000B
EB06 80         DB 10000000B
EB07 04         DB 4 ; 51 Q
EB08 40         DB 01000000B
EB09 A0         DB 10100000B
EB0A A0         DB 10100000B
EB0B A0         DB 10100000B
EB0C 50         DB 01010000B
EB0D 04         DB 4 ; 52 R
EB0E E0         DB 11100000B
EB0F 90         DB 10010000B
EB10 E0         DB 11100000B
EB11 A0         DB 10100000B
EB12 90         DB 10010000B
EB13 03         DB 3 ; 53 S
EB14 E0         DB 11100000B
EB15 80         DB 10000000B
EB16 E0         DB 11100000B
EB17 20         DB 00100000B
EB18 E0         DB 11100000B
EB19 03         DB 3 ; 54 T
EB1A E0         DB 11100000B
EB1B 40         DB 01000000B
EB1C 40         DB 01000000B
EB1D 40         DB 01000000B
EB1E 40         DB 01000000B
EB1F 04         DB 4 ; 55 U
EB20 A0         DB 10100000B
EB21 A0         DB 10100000B
EB22 A0         DB 10100000B
EB23 A0         DB 10100000B
EB24 50         DB 01010000B
EB25 05         DB 5 ; 56 V
EB26 88         DB 10001000B
EB27 88         DB 10001000B
EB28 88         DB 10001000B
EB29 50         DB 01010000B
EB2A 20         DB 00100000B
EB2B 05         DB 5 ; 57 W
EB2C 88         DB 10001000B
EB2D 88         DB 10001000B
EB2E A8         DB 10101000B
EB2F D8         DB 11011000B
EB30 88         DB 10001000B
EB31 03         DB 3 ; 58 X
EB32 A0         DB 10100000B
EB33 A0         DB 10100000B
EB34 40         DB 01000000B
EB35 A0         DB 10100000B
EB36 A0         DB 10100000B
EB37 03         DB 3 ; 59 Y
EB38 A0         DB 10100000B
EB39 A0         DB 10100000B
EB3A 40         DB 01000000B
EB3B 40         DB 01000000B
EB3C 40         DB 01000000B
EB3D 03         DB 3 ; 5A Z
EB3E E0         DB 11100000B

EB3F 20         DB 00100000B
EB40 40         DB 01000000B
EB41 80         DB 10000000B
EB42 E0         DB 11100000B
EB43 02         DB 2 ; 5B [
EB44 C0         DB 11000000B
EB45 80         DB 10000000B
EB46 80         DB 10000000B
EB47 80         DB 10000000B
EB48 C0         DB 11000000B
EB49 05         DB 5 ; 5C
EB4A 80         DB 10000000B
EB4B 40         DB 01000000B
EB4C 20         DB 00100000B
EB4D 10         DB 00010000B
EB4E 08         DB 00001000B
EB4F 02         DB 2 ; 5D ]
EB50 C0         DB 11000000B
EB51 40         DB 01000000B
EB52 40         DB 01000000B
EB53 40         DB 01000000B
EB54 C0         DB 11000000B
EB55 05         DB 5 ; 5E ↑
EB56 20         DB 00100000B
EB57 70         DB 01110000B
EB58 A8         DB 10101000B
EB59 20         DB 00100000B
EB5A 20         DB 00100000B
EB5B 05         DB 5 ; 5F BACK ARROW
EB5C 20         DB 00100000B
EB5D 40         DB 01000000B
EB5E F8         DB 11111000B
EB5F 40         DB 01000000B
EB60 20         DB 00100000B
EB61 02         DB 2 ; 60 •
EB62 80         DB 10000000B
EB63 40         DB 01000000B
EB64 00         DB 00000000B
EB65 00         DB 00000000B
EB66 00         DB 00000000B
                ;
B800            END FDOS
```

Tax Calculation Program

By Gary O. Young

Ever wonder what the effect would be on your taxes if you earned more income or lowered your taxable income by making a deductible investment? Here is a program that will tell you approximately what your taxes are now and what they would be if you raised or lowered your taxable income.

The program is written in North Star DOS BASIC and fits in less than 3K of memory. It contains the Federal and California State tax tables for single taxpayers making over $10,200 per year. These are contained in DATA statements and can be easily changed.

Using the adjusted gross income (gross income less normal deductions), the program calculates the Federal and California State taxes plus FICA. The program also calculates the percentage of each tax to the total tax and to the total adjusted gross income.

With the adjusted gross as a base, the program requests an adjustment to this gross as if extra income were earned (adding to the adjusted gross) or tax deductible investments were made (subtracting from the adjusted gross). The taxes and percentages are then calculated for this new amount.

Finally the program will display the changes between the current figures and the previous ones. It will list the change in taxable income, corresponding changes in taxes, percentages of each tax to the total taxes, and percentage of the change in taxes to the change in income. In this way you can tell what percentage of that extra income will be consumed in taxes, or how much you will save in taxes by making that investment.

```
100 REM 1040 TAX CALCULATION PROGRAM
200 REM WRITTEN BY GARY YOUNG
300 REM              SURF COMPUTER SERVICES
400 REM              PO BOX 66572
500 REM              LOS ANGELES, CA 90066
600 REM              (213) 399-7838
700 REM
800 REM WRITTEN IN NORTH STAR BASIC REL 3 FOR AN IMSAI 8080
900 PRINT "1040 TAX PROGRAM VERSION 4"
1000 DIM T1(4,18),T2(4,11)
1100 DATA 0,2200,0,0
1200 DATA 2200,2700,0,14
1300 DATA 2700,3200,70,15
1400 DATA 3200,3700,145,16
1500 DATA 3700,4200,225,17
1600 DATA 4200,6200,310,19
1700 DATA 6200,8200,690,21
1800 DATA 8200,10200,1110,24
1900 DATA 10200,12200,1590,25
2000 DATA 12200,14200,2090,27
2100 DATA 14200,16200,2630,29
2200 DATA 16200,18200,3210,31
2300 DATA 18200,20200,3830,34
2400 DATA 20200,22200,4510,36
2500 DATA 22200,24200,5230,38
2600 DATA 24200,28200,5990,40
2700 DATA 28200,34200,7590,45
2800 DATA 34200,40200,10290,50
2900 REM CALIF STATE SINGLE TAXPAYERS
3000 DATA 0,2000,0,1
3100 DATA 2000,3500,20,2
3200 DATA 3500,5000,50,3
3300 DATA 5000,6500,95,4
3400 DATA 6500,8000,155,5
3500 DATA 8000,9500,230,6
3600 DATA 9500,11000,320,7
3700 DATA 11000,12500,425,8
3800 DATA 12500,14000,545,9
3900 DATA 14000,15500,680,10
4000 DATA 15500,1000000,830,11
4100 FOR J=1 TO 18
4200 READ T1(1,J),T1(2,J),T1(3,J),T1(4,J)
4300 NEXT J
4400 FOR J=1 TO 11
4500 READ T2(1,J),T2(2,J),T2(3,J),T2(4,J)
4600 NEXT J
4700 DIM A4$(8)
4800 DIM A(60)
4900 K1=60
5000 REM M1 IS THE MODE, M2 IS FIRST TAB, M3 IS SECOND TAB
5100 REM M4=SET PAPER SWITCH
5200 M4=0
5300 M2=25\M3=33
5400 INPUT "NEW OR OLD RUN? ",A1$
5500 IF A1$="NEW" THEN 6400
5600 IF A1$<>"OLD" THEN 5400
5700 INPUT "FILE NAME? ",A2$
5800 OPEN #0,A2$
5900 FOR J=1 TO K1
6000 READ #0,A(J)
6100 NEXT J
6200 CLOSE #0
6300 GOTO 6800
6400 FOR J=1 TO K1
6500 A(J)=0
6600 NEXT J
6700 GOTO 7400
6800 INPUT "LIST OR UPDATE? ",A3$
6900 IF A3$="LIST" THEN 8000
7000 IF A3$="UPDATE" THEN 7200
7100 GOTO 6800
7200 IF A1$="OLD" THEN 7700
7300 REM M1=0 FOR UPDATING NEW
7400 M1=0
7500 GOTO 8400
7600 REM M1=1 FOR UPDATING OLD
7700 M1=1
7800 GOTO 8400
7900 REM M1=2 FOR LISTING ONLY
8000 M1=2
8100 IF M4>0 THEN 8400
8200 M4=1
8300 INPUT "SET PAPER AND RETURN",A3$
8400 J1=0
8500 REM UPDATE NEW OR LIST (SEQUENTIAL OPERATION)
8600 IF M1=1 THEN 8900
8700 GOTO 9100
8800 REM UPDATE OLD LOOP
8900 INPUT "LINE? ",J1
9000 IF J1=999 THEN 37300
9100 REM BEGIN CYCLING THRU THE FS
9200 IF M1<>1 THEN 9400
9300 IF J1<>1 THEN 9900
9400 PRINT "001 NUMBER OF EXEMPTIONS",TAB(M2),%3I,A(8)
9500 IF M1=2 THEN 10000
9600 INPUT A(8)
9700 IF M1=1 THEN 8900
9800 GOTO 10000
9900 IF J1<>10 THEN 10500
10000 PRINT "010 WAGES, SALARIES, TIPS ",TAB(M3),%9F2,A(1)
10100 IF M1=2 THEN 10600
10200 INPUT A(1)
10300 IF M1=1 THEN 8900
10400 GOTO 10600
10500 IF J1<>12 THEN 11100
10600 PRINT "012 DIVIDENDS",TAB(M3),%9F2,A(2)
10700 IF M1=2 THEN 11200
10800 INPUT A(2)
10900 IF M1=1 THEN 8900
11000 GOTO 11200
11100 IF J1<>14 THEN 11700
11200 PRINT "014 INTEREST INCOME",TAB(M3),%9F2,A(3)
11300 IF M1=2 THEN 11800
11400 INPUT A(3)
11500 IF M1=1 THEN 8900
11600 GOTO 11800
11700 IF J1<>15 THEN 12600
11800 PRINT "015 OTHER INCOME",TAB(M3),%9F2,A(4)
11900 IF M1=2 THEN 12700
12000 INPUT A(4)
12100 IF M1=1 THEN 8900
12200 INPUT "DO YOU WANT TO DO BUSINESS CALC? ",A4$
12300 IF A4$="N" THEN 18700
12400 IF A4$<>"Y" THEN 12200
12500 GOTO 12700
12600 IF J1<>40 THEN 13300
12700 IF A(18)=0 AND M1=2 THEN 18700
12800 PRINT "040 GROSS INCOME ON BUS.",TAB(M2),%9F2,A(18)
12900 IF M1=2 THEN 13400
```

```
TAX COMPUTATION PROGRAM
ENTER ADJUSTED GROSS INCOME 17000


ADJUSTED GROSS    $17000.00
FEDERAL TAX        $3458.00    %-OF-TAX   60.1    %-OF-GRS   20.3
STATE TAX           $995.00    %-OF-TAX   17.3    %-OF-GRS    5.9
FICA               $1303.50    %-OF-TAX   22.6    %-OF-GRS    7.7
TOTAL TAX          $5756.50    %-OF-TAX  100.0    %-OF-GRS   33.9


WANT TO ADJUST THE INCOME? Y
ENTER ADJUSTMENT TO GROSS -2000


ADJUSTED GROSS    $15000.00
FEDERAL TAX        $2862.00    %-OF-TAX   59.3    %-OF-GRS   19.1
STATE TAX           $780.00    %-OF-TAX   16.2    %-OF-GRS    5.2
FICA               $1185.00    %-OF-TAX   24.5    %-OF-GRS    7.9
TOTAL TAX          $4827.00    %-OF-TAX  100.0    %-OF-GRS   32.2

CHANGES FROM THE PREVIOUS RUN
CHANGE IN GROSS   $-2000.00                        %-CHANGE  -11.8
FEDERAL TAX        $-596.00    %-OF-TAX   64.1    %-OF-GRS   29.8
STATE TAX          $-215.00    %-OF-TAX   23.1    %-OF-GRS   10.8
FICA               $-118.50    %-OF-TAX   12.7    %-OF-GRS    5.9
TOTAL TAX          $-929.50    %-OF-TAX    .0     %-OF-GRS   46.5


WANT TO ADJUST THE INCOME? Y
ENTER ADJUSTMENT TO GROSS 1000


ADJUSTED GROSS    $16000.00
FEDERAL TAX        $3152.00    %-OF-TAX   59.5    %-OF-GRS   19.7
STATE TAX           $885.00    %-OF-TAX   16.7    %-OF-GRS    5.5
FICA               $1264.00    %-OF-TAX   23.8    %-OF-GRS    7.9
TOTAL TAX          $5301.00    %-OF-TAX  100.0    %-OF-GRS   33.1

CHANGES FROM THE PREVIOUS RUN
CHANGE IN GROSS   $1000.00                         %-CHANGE    6.7
FEDERAL TAX         $290.00    %-OF-TAX   61.2    %-OF-GRS   29.0
STATE TAX           $105.00    %-OF-TAX   22.2    %-OF-GRS   10.5
FICA                 $79.00    %-OF-TAX   16.7    %-OF-GRS    7.9
TOTAL TAX           $474.00    %-OF-TAX    .0     %-OF-GRS   47.4


WANT TO ADJUST THE INCOME? N
READY
```

```
13000 INPUT A(18)
13100 IF M1=1 THEN 8900
13200 GOTO 13400
13300 IF J1<>100 THEN 14200
13400 PRINT "100 MILES TRAVELED",TAB(M2),%9F2,A(17)
13500 IF M1=2 THEN 13800
13600 INPUT A(17)
13700 IF M1=1 THEN 8900
13800 C1=A(17)*.15
13900 PRINT "*** MILEAGE EXPENSE",TAB(M2),%9F2,C1
14000 IF M1=2 THEN 14300
14100 GOTO 14300
14200 IF J1<>110 THEN 14800
14300 PRINT "110 PLANE, BUS, TAXI",TAB(M2),%9F2,A(19)
14400 IF M1=2 THEN 14900
14500 INPUT A(19)
14600 IF M1=1 THEN 8900
14700 GOTO 14900
14800 IF J1<>120 THEN 15400
14900 PRINT "120 ADVERTISING       ",TAB(M2),%9F2,A(20)
15000 IF M1=2 THEN 15500
15100 INPUT A(20)
15200 IF M1=1 THEN 8900
15300 GOTO 15500
15400 IF J1<>130 THEN 16000
15500 PRINT "130 OFFICE EXPENSES",TAB(M2),%9F2,A(21)
15600 IF M1=2 THEN 16100
15700 INPUT A(21)
15800 IF M1=1 THEN 8900
15900 GOTO 16100
16000 IF J1<>140 THEN 16600
16100 PRINT "140 DEPRECIATION",TAB(M2),%9F2,A(22)
16200 IF M1=2 THEN 16700
16300 INPUT A(22)
16400 IF M1=1 THEN 8900
16500 GOTO 16700
16600 IF J1<> 145 THEN 17200
16700 PRINT "145 REPAIRS",TAB(M2),%9F2,A(23)
16800 IF M1=2 THEN 17300
16900 INPUT A(23)
17000 IF M1=1 THEN 8900
17100 GOTO 17300
17200 IF J1<>150 THEN 17800
17300 PRINT "150 TAX ON EQUIPMENT",TAB(M2),%9F2,A(24)
17400 IF M1=2 THEN 17900
17500 INPUT A(24)
17600 IF M1=1 THEN 8900
17700 GOTO 17900
17800 IF J1<>160 THEN 19000
17900 PRINT "160 JOURNALS AND MAG",TAB(M2),%9F2,A(25)
18000 IF M1=2 THEN 18300
18100 INPUT A(25)
18200 IF M1=1 THEN 8900
18300 A(35)=A(17)*.15+A(19)+A(20)+A(21)+A(22)+A(23)+A(24)
                                                +A(25)
18400 PRINT "*** TOTAL EXPENSES",TAB(M2),%9F2,A(35)
18500 A(36)=A(18)-A(35)
18600 PRINT "*** NET BUSINESS INCOME",TAB(M3),%9F2,A(36)
18700 A(5)=A(1)+A(2)+A(3)+A(4)+A(36)
18800 PRINT "*** TOTAL INCOME",TAB(M3),%9F2,A(5)
18900 GOTO 19100
19000 IF J1<>50 THEN 20300
19100 PRINT "050 ADJUSTMENTS TO INCOME",TAB(M3),%9F2,A(6)
19200 IF M1=2 THEN 19500
19300 INPUT A(6)
19400 IF M1=1 THEN 8900
19500 A(7)=A(5)-A(6)
19600 PRINT "*** ADJUSTED GROSS INCOME",TAB(M3),%9F2,A(7)
19700 PRINT
19800 IF M1<>0 THEN 20400
19900 INPUT "WANT TO ITEMIZE DEDUCTIONS? ",A4$
20000 IF A4$="N" THEN 26800
20100 IF A4$<>"Y" THEN 19900
20200 GOTO 20400
20300 IF J1<>200 THEN 20900
20400 PRINT "200 MEDICAL INSURANCE",TAB(M2),%9F2,A(40)
20500 IF M1=2 THEN 21000
20600 INPUT A(40)
20700 IF M1=1 THEN 8900
20800 GOTO 21000
20900 IF J1<>210 THEN 21500
21000 PRINT "210 MEDICINE AND DRUGS",TAB(M2),%9F2,A(41)
21100 IF M1=2 THEN 21600
21200 INPUT A(41)
21300 IF M1=1 THEN 8900
21400 GOTO 21600
21500 IF J1<>220 THEN 23400
21600 PRINT "220 OTHER MEDICAL EXPENSE",TAB(M2),%9F2,A(42)
21700 IF M1=2 THEN 22000
21800 INPUT A(42)
21900 IF M1=1 THEN 8900
22000 C1=A(41)/2
22100 IF C1>150 THEN C1=150
22200 C2=A(7)*.01
22300 C3=A(41)-C2
22400 IF C3<0 THEN C3=0
22500 C4=A(40)-C1
22600 C5=C3+A(40)-C1+A(42)
22700 C6=A(7)*.03
22800 C7=C5-C6
22900 IF C7<0 THEN C7=0
23000 A(43)=C1+C7
23100 PRINT "*** MEDICAL DEDUCTION",TAB(M2),%9F2,A(43)
23200 IF M1=2 THEN 23500
23300 GOTO 23500
23400 IF J1<>240 THEN 24000
23500 PRINT "240 STATE AND LOCAL TAX",TAB(M2),%9F2,A(44)
23600 IF M1=2 THEN 24100
23700 INPUT A(44)
23800 IF M1=1 THEN 8900
23900 GOTO 24100
24000 IF J1<>250 THEN 24600
24100 PRINT "250 OTHER TAXES",TAB(M2),%9F2,A(45)
24200 IF M1=2 THEN 24700
24300 INPUT A(45)
24400 IF M1=1 THEN 8900
24500 GOTO 24700
24600 IF J1<>260 THEN 25200
24700 PRINT "260 INTEREST EXPENSE",TAB(M2),%9F2,A(46)
24800 IF M1=2 THEN 25300
24900 INPUT A(46)
25000 IF M1=1 THEN 8900
25100 GOTO 25300
25200 IF J1<>270 THEN 25800
25300 PRINT "270 CONTRIBUTIONS",TAB(M2),%9F2,A(47)
25400 IF M1=2 THEN 25900
25500 INPUT A(47)
25600 IF M1=1 THEN 8900
25700 GOTO 25900
25800 IF J1<>280 THEN 26400
25900 PRINT "280 CASUALTY OR THEFT",TAB(M2),%9F2,A(48)
26000 IF M1=2 THEN 26500
26100 INPUT A(48)
26200 IF M1=1 THEN 8900
26300 GOTO 26500
26400 IF J1<>290 THEN 29200
26500 PRINT "290 MISC DEDUCTIONS",TAB(M2),%9F2,A(49)
26600 IF M1=2 THEN 26900
26700 INPUT A(49)
26800 IF M1=1 THEN 8900
26900 A(50)=A(43)+A(44)+A(45)+A(46)+A(47)+A(48)+A(49)
27000 PRINT "*** ITEMIZED DEDUCTIONS",TAB(M3),%9F2,A(50)
27100 D=A(7)*.16
27200 IF D>1700 THEN A(9)=D ELSE A(9)=1700
27300 IF A(9)>2400 THEN A(9)=2400
27400 PRINT "*** STANDARD DEDUCTION",TAB(M3),%9F2,A(9)
27500 IF A(9)>A(50) THEN 27900
27600 PRINT "*** ITEMIZED DEDUCTIONS USED"
27700 A(9)=A(50)
27800 GOTO 28000
27900 PRINT "*** STANDARD DEDUCTIONS USED"
28000 A(10)=A(8)*750
28100 PRINT "*** STANDARD EXEMPTION",TAB(M3),%9F2,A(10)
28200 A(11)=A(7)-A(9)-A(10)
28300 PRINT "*** TAXABLE INCOME",TAB(M3),%9F2,A(11)
28400 PRINT
28500 REM TAX CREDITS
28600 C1=35*A(8)
28700 C2=.02*A(11)
28800 IF C2>160 THEN C2=160
28900 IF C2<C1 THEN C2=C1
29000 PRINT "*** TAX CREDIT",TAB(M3),%9F2,C2
29100 GOTO 29300
29200 IF J1<>86 THEN 30800
29300 PRINT "086 OTHER TAXES OWED",TAB(M3),%9F2,A(12)
29400 IF M1=2 THEN 29700
29500 INPUT A(12)
29600 IF M1=1 THEN 8900
29700 G1=A(11)
29800 GOSUB 38700
29900 A(29)=T1
30000 PRINT "*** FEDERAL TAX",TAB(M3),%9F2,A(29)
30100 GOSUB 40400
30200 A(30)=T3
30300 PRINT "*** F.I.C.A.",TAB(M3),%9F2,A(30)
30400 A(13)=A(29)+A(12)+A(30)-C2
30500 PRINT "*** TOTAL FEDERAL TAXES OWED",TAB(M3),%9F2,A(13)
30600 PRINT
30700 GOTO 30900
30800 IF J1<>90 THEN 31400
30900 PRINT "090 FEDERAL TAX WITHHELD",TAB(M3),%9F2,A(14)
31000 IF M1=2 THEN 31500
31100 INPUT A(14)
31200 IF M1=1 THEN 8900
31300 GOTO 31500
31400 IF J1<>95 THEN 32000
31500 PRINT "095 ESTIMATED TAX PAYMENTS",TAB(M3),%9F2,A(15)
31600 IF M1=2 THEN 32100
31700 INPUT A(15)
31800 IF M1=1 THEN 8900
31900 GOTO 32100
32000 IF J1<>97 THEN 33700
32100 PRINT "097 F.I.C.A. WITHHELD",TAB(M3),%9F2,A(27)
32200 IF M1=2 THEN 32500
```

1978
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CIRCLE INQUIRY NO. 9

```
32300 INPUT A(27)
32400 IF M1=1 THEN 8900
32500 A(16)=A(15)+A(14)+A(27)
32600 PRINT "*** TOTAL TAX PAYMENTS",TAB(M3),%9F2,A(16)
32700 PRINT
32800 C1=A(16)-A(13)
32900 IF C1<0 THEN 33300
33000 PRINT "*** IRS OWES YOU ",TAB(M3),%9F2,C1
33100 PRINT
33200 GOTO 33800
33300 C1=ABS(C1)
33400 PRINT "*** YOU OWE IRS ",TAB(M3),%9F2,C1
33500 PRINT
33600 GOTO 33800
33700 IF J1<>98 THEN 34300
33800 PRINT "098 CALIF TAX WITHHELD",TAB(M3),%9F2,A(28)
33900 IF M1=2 THEN 34400
34000 INPUT A(28)
34100 IF M1=1 THEN 8900
34200 GOTO 34400
34300 IF J1<>93 THEN 37100
34400 PRINT "093 CALIF ESTIMATED PAYMENTS",TAB(M3),%9F2,A(32)
34500 IF M1=2 THEN 34900
34600 INPUT A(32)
34700 IF M1=1 THEN 8900
34800 REM CALIFORNIA STANDARD DEDUCTIONS
34900 C1=1000*A(8)
35000 G1=A(5)-C1
35100 PRINT "*** CALIF STANDARD DEDUCTIONS",TAB(M3),%9F2,C1
35200 PRINT "*** CALIF TAXABLE INCOME",TAB(M3),%9F2,G1
35300 GOSUB 39600
35400 A(31)=T2
35500 A(33)=A(32)+A(28)
35600 PRINT "*** TOTAL CALIF TAX PAID",TAB(M3),%9F2,A(33)
35700 PRINT "*** TOTAL CALIF TAX OWED",TAB(M3),%9F2,A(31)
35800 C1=A(33)-A(31)
35900 IF C1>0 THEN 36200
36000 PRINT "*** OWE CALIF TAX",TAB(M3),%9F2,ABS(C1)
36100 GOTO 36300
36200 PRINT "*** REFUND CALIF TAX ",TAB(M3),%9F2,C1
36300 PRINT\PRINT\PRINT
36400 PRINT "*** FED TAX % OF INCOME",TAB(M3),%9F2,A(13)/A(7)*100
36500 PRINT "*** CALIF TAX % OF INCOME",TAB(M3),%9F2,A(31)/A(7)*100
36600 PRINT "*** F.I.C.A. % OF INCOME",TAB(M3),%9F2,A(30)/A(7)*100
36700 T3=A(13)+A(31)+A(30)
36800 PRINT "*** TOTAL TAX % OF INCOME",TAB(M3),%9F2,T3*100/A(7)
36900 PRINT\PRINT\PRINT
37000 IF M1<>1 THEN 37300
37100 PRINT "LINE NO. ",%4I,J1," NOT RECOGNIZED"
37200 GOTO 8900
37300 IF M1=2 THEN 41400
37400 INPUT "DO YOU WANT TO SAVE THE RESULTS?  ",A4$
37500 IF A4$="N" THEN 38300
37600 IF A4$<>"Y" THEN 37400
37700 INPUT "OUTPUT FILE NAME? ",A4$
37800 OPEN #0,A4$
37900 FOR J=1 TO K1
38000 WRITE #0,A(J)
38100 NEXT J
38200 CLOSE #0
38300 INPUT "DO YOU WANT A LISTING? ",A4$
38400 IF A4$="N" THEN 41400
38500 IF A4$<>"Y" THEN 38300
38600 GOTO 8000
38700 REM ACTUAL CALCULATION SUBROUTINE
38800 REM FEDERAL TAX CALCULATION
38900 FOR J=1 TO 18
39000 IF G1>T1(2,J) THEN 39300
39100 T1=T1(3,J)+(G1-T1(1,J))*T1(4,J)*.01
39200 GOTO 39500
39300 NEXT J
39400 PRINT "AMOUNT NOT IN FED TAX TABLE ",G1
39500 RETURN
39600 REM STATE TAX CALCULATIONS
39700 FOR J=1 TO 11
39800 IF G1>T2(2,J) THEN 40100
39900 T2=T2(3,J)+(G1-T2(1,J))*T2(4,J)*.01
40000 GOTO 40300
40100 NEXT J
40200 PRINT "AMOUNT NOT IN CALIF TAX TABLE ",G1
40300 RETURN
40400 REM FICA CALCULATION
40500 G1=A(1)
40600 IF G1>16500 THEN G1=16500
40700 T3=G1*.059
40800 IF G1=16500 THEN RETURN
40900 G2=G1+A(36)
41000 IF G2>16500 THEN G2=16500
41100 G2=G2-G1
41200 T3=T3+G2*.079
41300 RETURN
41400 INPUT "WANT ANOTHER RUN? ",A4$
41500 IF A4$="Y" THEN 41700
41600 STOP
41700 A1$="OLD"
41800 GOTO 6800
READY
```

The Tax Man

by Gary O. Young

Here's a game that will get you in shape for the April IRS Olympics. The program will ask the same questions as a 1040, itemized deductions, and business expense tax forms. The program then calculates the taxes owed and subtracts the taxes paid. If you get a refund, you win this game. If you owe Uncle Sam, you lose. To make the game more complete, California State income tax and FICA are also calculated.

The program was written using North Star DOS BASIC and can save a copy of the data in a file to update or print later.

The game runs in three modes — "New", "Old Update", and "Old List". In "New" mode the variables are initialized and all the questions are asked sequentially. After answering all the questions with the appropriate amounts, the program will save the results in a file and list the tax forms doing all the calculations. When it lists the forms, some lines will begin with a three digit number and the rest will begin with three asterisks. The values on the lines with the asterisks are generated by the program such as calculated tax. The lines with the numbers are input by the player (payer) and can be changed or updated later.

In the "Old Update" mode, the data are read from a data file generated earlier. The program then requests a line number which corresponds to the three-digit number on the input lines during a "New" run. That line is printed along with the current amount for verification and requests a new value for that item. A line number 999 terminates the update. Then as in the "New" mode, the data are saved on a file and the forms are printed.

In the "Old List" mode, the data are read from a previously generated file, the tax forms are printed, and the tax is calculated. No updating takes place.

The game is played by first running in "New" mode with accurate current data to establish a base. Then run in "Old Update" mode to change an item and see the resultant changes, i.e., change the gross income, deduction, or number of deductions.

The program contains the tax tables for California State and Federal income tax for single taxpayers. These are contained in data statements in the beginning of the program and can easily be changed for any state or table. The format of the data statements is lower limit, upper limit, tax amount, and percentage of amount over the lower limit. FICA is calculated at 5.9% for income earned in wages, salaries, and tips, and 7.9% for business income up to a $16,500 limit.

The adjusted gross income is derived from the wages, salaries, and tips, dividends, interest income, other income, net business income, and adjustments to income. The net business income is derived by subtracting mileage expense, advertising, travel, office expense, depreciation, repairs, tax on equipment, and magazines and journals from the gross business income. These categories can be easily changed to be appropriate to a particular business.

Next the program will calculate the standard and itemized deductions and use the larger of the two. The medical deduction is derived using the medical insurance, medicine and drugs, and other medical expenses. This deduction is added to the State and local taxes, other taxes (real estate taxes), interest expense, contributions, casualty and theft, and miscellaneous deductions (tax preparation charges) to get the final itemized deduction.

The program takes into account tax credits, other taxes owed, excess FICA paid, Federal tax and FICA withheld, and estimated payments made to calculate the final refund (hopefully) or payment to IRS.

The California tax is calculated using the adjusted gross income and standard California deduction. The California tax withheld and estimated payments made are subtracted to derive the California tax refund or payment.

To make you feel even worse while playing this game, the program will print the percent of your income that goes to each tax.

The program takes about 10K, but can be shortened by eliminating the disc file save and some of the detail lines. Also, the questions or categories can be changed to be more applicable to a particular situation. This program is not intended to be the final word on April 15th. It is intended to show the approximate outcome of a change in some of the data on a 1040 tax form before the critical date.

```
1040 TAX PROGRAM VERSION 4
NEW OR OLD RUN? NEW
001 NUMBER OF EXEMPTIONS   0
?1
010 WAGES, SALARIES, TIPS                    .00
?20000
012 DIVIDENDS                                .00
?200
014 INTEREST INCOME                          .00
?350
015 OTHER INCOME                             .00
?150
DO YOU WANT TO DO BUSINESS CALC? Y
040 GROSS INCOME ON BUS.              .00
?2500
100 MILES TRAVELED                    .00
?2000
*** MILEAGE EXPENSE                300.00
110 PLANE, BUS, TAXI                  .00
?50
120 ADVERTISING                       .00
?200
130 OFFICE EXPENSES                   .00
?125
140 DEPRECIATION                      .00
?500
145 REPAIRS                           .00
?50
150 TAX ON EQUIPMENT                  .00
?30
160 JOURNALS AND MAG                  .00
?40
*** TOTAL EXPENSES                1295.00
*** NET BUSINESS INCOME                    1205.00
*** TOTAL INCOME                          21905.00
050 ADJUSTMENTS TO INCOME                     .00
?0
*** ADJUSTED GROSS INCOME                 21905.00
```

```
WANT TO ITEMIZE DEDUCTIONS? Y
200 MEDICAL INSURANCE                .00
?400
210 MEDICINE AND DRUGS               .00
?50
220 OTHER MEDICAL EXPENSE            .00
?100
*** MEDICAL DEDUCTION              25.00
240 STATE AND LOCAL TAX              .00
?1000
250 OTHER TAXES                      .00
?200
260 INTEREST EXPENSE                 .00
?700
270 CONTRIBUTIONS                    .00
?100
280 CASUALTY OR THEFT                .00
?0
290 MISC DEDUCTIONS                  .00
?200
*** ITEMIZED DEDUCTIONS                    2225.00
*** STANDARD DEDUCTION                     2400.00
*** STANDARD DEDUCTIONS USED
*** STANDARD EXEMPTION                      750.00
*** TAXABLE INCOME                       18755.00

*** TAX CREDIT                              180.00
086 OTHER TAXES OWED                          .00
?0
*** FEDERAL TAX                            4018.70
*** F.I.C.A.                                973.50
*** TOTAL FEDERAL TAXES OWED               4812.20

090 FEDERAL TAX WITHHELD                      .00
?4000
095 ESTIMATED TAX PAYMENTS                    .00
?200
097 F.I.C.A. WITHHELD                         .00
?900
*** TOTAL TAX PAYMENTS                     5100.00

*** IRS OWES YOU                            287.80

098 CALIF TAX WITHHELD                        .00
?1200
093 CALIF ESTIMATED PAYMENTS                  .00
?200
*** CALIF STANDARD DEDUCTIONS              1000.00
*** CALIF TAXABLE INCOME                  20905.00
*** TOTAL CALIF TAX PAID                   1400.00
*** TOTAL CALIF TAX OWED                   1424.55
*** OWE CALIF TAX                            24.55



*** FED TAX % OF INCOME                      21.97
*** CALIF TAX % OF INCOME                     6.50
*** F.I.C.A. % OF INCOME                      4.44
*** TOTAL TAX % OF INCOME                    32.92



DO YOU WANT TO SAVE THE RESULTS?  N
DO YOU WANT A LISTING? Y
SET PAPER AND RETURN



001 NUMBER OF EXEMPTIONS    1
```

```
010 WAGES, SALARIES, TIPS                 20000.00
012 DIVIDENDS                               200.00
014 INTEREST INCOME                         350.00
015 OTHER INCOME                            150.00
040 GROSS INCOME ON BUS.     2500.00
100 MILES TRAVELED           2000.00
*** MILEAGE EXPENSE           300.00
110 PLANE, BUS, TAXI           50.00
120 ADVERTISING               200.00
130 OFFICE EXPENSES           125.00
140 DEPRECIATION              500.00
145 REPAIRS                    50.00
150 TAX ON EQUIPMENT           30.00
160 JOURNALS AND MAG           40.00
*** TOTAL EXPENSES           1295.00
*** NET BUSINESS INCOME                     1205.00
*** TOTAL INCOME                          21905.00
050 ADJUSTMENTS TO INCOME                     .00
*** ADJUSTED GROSS INCOME                 21905.00

200 MEDICAL INSURANCE         400.00
210 MEDICINE AND DRUGS         50.00
220 OTHER MEDICAL EXPENSE     100.00
*** MEDICAL DEDUCTION          25.00
240 STATE AND LOCAL TAX      1000.00
250 OTHER TAXES               200.00
260 INTEREST EXPENSE          700.00
270 CONTRIBUTIONS             100.00
280 CASUALTY OR THEFT             .00
290 MISC DEDUCTIONS           200.00
*** ITEMIZED DEDUCTIONS                    2225.00
*** STANDARD DEDUCTION                     2400.00
*** STANDARD DEDUCTIONS USED
*** STANDARD EXEMPTION                      750.00
*** TAXABLE INCOME                       18755.00

*** TAX CREDIT                              180.00
086 OTHER TAXES OWED                          .00
*** FEDERAL TAX                            4018.70
*** F.I.C.A.                                973.50
*** TOTAL FEDERAL TAXES OWED               4812.20

090 FEDERAL TAX WITHHELD                   4000.00
095 ESTIMATED TAX PAYMENTS                  200.00
097 F.I.C.A. WITHHELD                       900.00
*** TOTAL TAX PAYMENTS                     5100.00

*** IRS OWES YOU                            287.80

098 CALIF TAX WITHHELD                     1200.00
093 CALIF ESTIMATED PAYMENTS                200.00
*** CALIF STANDARD DEDUCTIONS              1000.00
*** CALIF TAXABLE INCOME                  20905.00
*** TOTAL CALIF TAX PAID                   1400.00
*** TOTAL CALIF TAX OWED                   1424.55
*** OWE CALIF TAX                            24.55



*** FED TAX % OF INCOME                      21.97
*** CALIF TAX % OF INCOME                     6.50
*** F.I.C.A. % OF INCOME                      4.44
*** TOTAL TAX % OF INCOME                    32.92

WANT ANOTHER RUN? Y
LIST OR UPDATE? UPDATE
LINE? 240
240 STATE AND LOCAL TAX      1000.00
?1600
LINE? 999
DO YOU WANT TO SAVE THE RESULTS?  N
```

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- Automatic time and scorekeeping
- Battery free AC operation
- Dual controls with 8-way action
- Built-in Pro Hockey and Tennis games
- Easy hook-up on any B-W or Color TV
- Factory warranty

Channel F — additional cartridges — $17.95 ea.

0811 Tic Tac-Toe/Shooting Gallery
0812 Quadra-doodle/Doodle
0813 Desert Fox Shooting Gallery
0814 Blackjack (1 or 2 players)
0815 Spitfire (1 or 2 players)
0818 Spacewar (2 players)
Magic Numbers
(computer logic)
0819 Drag strip (1 or 2 players)
0820 Maze (2 players)
0822 Baseball (2 players)

D–SUB CONNECTORS

NO. PINS	PART NO.	PRICE	COVER PRICE
9	DE-9P	1.49	1.25
9	DE-9S	2.15	
15	DA-15P	2.11	1.50
15	DA-15S	3.10	
25	DB-25P	3.00	1.50
25	DB-25S	4.00	
37	DE-37P	4.14	2.00
37	DE-37S	6.00	
50	DD-50P	5.40	2.25
50	DD-50S	8.00	

EDGE CONNECTORS

NO. PINS	TYPE		
20 DUAL	10 PIN	GOLD	$ .50
30 DUAL	15 PIN	GOLD	.75
44 DUAL	22 PIN	GOLD	1.95
44 DUAL	22 PIN	GOLD	2.50
80 DUAL	40 PIN	GOLD	4.95
86 DUAL	43 PIN	GOLD(6800)	5.00
100 DUAL	50 PIN	GOLD(IMSAI/ALTAIR)	4.25
100 DUAL	50 PIN	GOLD(IMSAI/ALTAIR)	4.95
100 DUAL	50 PIN	GOLD(NO EARS-IMSAI	3.50
100 DUAL	50 PIN	TIN (.1" SPACING)	3.25

ALTAIR/IMSAI CARD GUIDES .25¢ EACH

CLOCK CHIPS

MM5309	6 Digit, BCD Outputs, Reset PIN	$9.95
MM5311	6 Digit, BCD Outputs, 12 or 24 Hour	4.95
MM5312	4 Digit, BCD Outputs, 1 PPS Output	4.95
MM5314	6 Digit, 12 or 24 Hour, 50 or 60 Hz	4.95
MM5316	4 Digit, Alarm, 1 PPS Output	6.95
MM5318	Video Clock Chip. For Use With (MM5841 $9.95)	9.95
CT7001	6 Digit, Calendar, Alarm, 12 or 24 Hour	5.95

Wire Wrap

	1-24	25-99	100-999	1K
10	.39	36	32	26
14	34	33	31	29
16	36	34	32	30
18	70	60	54	40
20	88	75	67	55
22	95	80	72	59
24	95	80	72	59
28	95	84	80	71
36	1.40	1.25	1.08	83
40	1.56	1.40	1.20	89

I C SOCKETS

Lo Profile-Solder Tin

	1-24	25-99	100-999	1K & Up
(8)	15	14	13	12
(14)	25	20	16	14
(16)	25	20	18	16
(18)	28	27	26	20
(20)	34	33	30	239
(22)	36	35	34	28
(24)	36	35	33	289
(28)	44	43	42	367
(40)	60	58	57	493

7400 TTL Series

7400	.18	7441	.75	7496	.80	74160	1.30
7401	.20	7442	.50	7497	4.00	74161	1.30
7402	.20	7443	1.20	74100	1.25	74162	1.90
7403	.20	7445	1.05	74107	.40	74163	1.40
7404	.20	7446	1.05	74109	.45	74164	1.50
7405	.25	7447	.85	74110	.80	74165	1.40
7406	.35	7448	.95	74116	2.00	74166	1.50
7407	.35	7450	.20	74120	1.25	74167	3.00
7408	.25	7451	.20	74121	.55	74170	2.00
7409	.25	7453	.20	74122	.45	74172	9.75
7410	.20	7454	.20	74123	.95	74173	1.50
7411	.25	7460	.20	74125	.55	74174	1.10
7412	.40	7470	.40	74126	.60	74175	1.20
7413	.75	7472	.35	74128	.65	74176	1.50
7416	.35	7473	.40	74132	1.50	74177	.90
7417	.40	7474	.40	74136	1.80	74180	1.00
7420	.20	7475	.70	74141	1.15	74181	2.00
7422	.75	7476	.40	74142	4.00	74182	.90
7425	.35	7479	2.00	74144	4.00	74184	2.00
7426	.30	7480	.69	74145	1.10	74185	2.00
7427	.35	7482	1.50	74147	2.50	74186	12.00
7428	.40	7483	.85	74148	1.75	74190	1.40
7429	.40	7485	1.10	74150	1.00	74191	1.25
7430	.25	7486	.40	74151	1.10	74192	1.10
7432	.30	7489	2.25	74153	1.10	74193	1.10
7433	.40	7490	.55	74154	1.10	74194	1.20
7437	.30	7491	1.10	74155	1.10	74195	1.00
7438	.35	7492	.60	74156	1.10	74196	1.10
7439	.36	7493	.60	74157	1.20	74197	1.30
7440	.20	7494	.85	74158	1.75	74198	1.50
		7495	.90	74159	3.60	74199	1.75

74LS00

74LS00	.29	74LS60	.29	74LS138	1.25	74LS192	2.25
74LS01	.29	74LS73	.49	74LS139	1.25	74LS193	2.25
74LS02	.29	74LS74	.49	74LS151	1.25	74LS194	1.89
74LS03	.29	74LS75	.69	74LS153	1.25	74LS195	1.87
74LS04	.29	74LS76	.49	74LS154	3.65	74LS196	1.87
74LS05	.35	74LS78	.65	74LS155	1.75	74LS197	1.87
74LS08	.29	74LS83AN	1.75	74LS156	1.85	74LS221	2.00
74LS10	.29	74LS85	2.25	74LS157	1.50	74LS240	3.00
74LS11	.40	74LS86	.69	74LS158	1.55	74LS241	3.00
74LS12	.50	74LS90	.89	74LS160	1.95	74LS242	3.00
74LS13	.69	74LS92	.89	74LS161	1.95	74LS243	2.60
74LS14	1.70	74LS93	.89	74LS162	1.95	74LS244	2.60
74LS15	.40	74LS95	1.50	74LS163	1.95	74LS247	1.68
74LS20	.29	74LS96	1.89	74LS164	1.95	74LS248	1.35
74LS21	.40	74LS107	.55	74LS165	2.00	74LS251	1.91
74LS22	.40	74LS109	.59	74LS166	2.00	74LS253	1.75
74LS26	.39	74LS112	.59	74LS168	2.00	74LS257	1.75
74LS27	.39	74LS113	.60	74LS169	2.00	74LS258	1.95
74LS28	.39	74LS114	.60	74LS170	4.00	74LS259	4.25
74LS30	.29	74LS122	.60	74LS173	2.00	74LS260	.50
74LS32	.39	74LS123	1.25	74LS174	1.87	74LS266	.68
74LS37	.48	74LS124	1.80	74LS175	1.95	74LS273	2.50
74LS38	.48	74LS125	.87	74LS181	3.69	74LS279	.79
74LS40	.39	74LS126	1.07	74LS189	6.16	74LS283	1.85
74LS42	1.20	74LS132	1.25	74LS190	2.49	74LS289	6.16
74LS47	1.25	74LS136	.59	74LS191	2.49	74LS290	1.56
74LS48	1.68					74LS293	1.56
74LS51	.29					74LS295	2.00
74LS52	.29					74LS298	2.00
74LS54	.29					74LS352	1.65
74LS55	.29					74LS367	.87
						74LS390	3.00
						74LS670	3.95

CMOS

34001	.40	4050	.61	4517	8.50		
4000	.25	4051	1.10	4518	1.65		
4001	.25	4052	1.10	4519	.90	MM74C173N	1.39
4002	.25	4053	1.10	4520	1.65	MM74C174N	1.39
4004	3.50	4060	3.25	4521	3.25	MM74C175N	1.39
4006	1.40	4061	7.00	4522	1.75	MM74C192N	1.71
4007	.25	4063	2.50	4527	3.00	MM74C193N	1.71
4008	1.25	4066	.85	4528	1.75	MM74C195N	1.61
4009	.48	4067	6.00	4583	1.45	MM74C200N	10.45
4010	.48	4068	.35	4584	.75	MM74C221N	2.43
4011	.25	4069	.35				
4012	.25	4070	.85			MM74C901N	.84
4013	.60	4071	.35			MM74C902N	.84
4014	1.25	4072	.35			MM74C903N	.84
4015	1.25	4073	.35	MM74C00N	.38	MM74C905N	11.20
4016	.59	4075	.35	MM74C02N	.38	MM74C906N	.84
4017	1.25	4076	1.85	MM74C04N	.38	MM74C907N	.84
4018	1.25	4077	.42	MM74C08N	.38	MM74C908N	3.80
4019	.70	4078	.35	MM74C10N	.38	MM74C909N	2.52
4020	1.25	4081	.35	MM74C14N	2.18	MM74C910N	10.45
4021	1.25	4082	.35	MM74C20N	.38	MM74C914N	2.18
4022	1.25	4085	1.35	MM74C30N	.38		
4023	.35	4086	1.45	MM74C32N	.38	MM74C915N	1.71
4024	1.00	4089	3.00	MM74C42N	1.42	MM74C918N	4.18
4025	.35	4093	1.75	MM74C48N	2.13	MM74C922N	5.65
4026	2.25	4098	2.50	MM74C73N	.84	MM74C923N	5.75
4027	.60	4160	1.75	MM74C74N	.87	MM74C925N	12.00
4028	1.25	4161	1.75	MM74C76N	.84		
4029	1.50	4162	1.75	MM74C83N	2.00	MM74C926N	12.00
4030	.60	4163	1.75	MM74C85N	2.00		
4032	1.60	4174	1.75	MM74C86N	.99	MM74C927N	12.00
4033	2.00	4175	1.60	MM74C89N	8.75		
4034	3.50	4194	1.80	MM74C90N	1.32	MM74C928N	12.00
4035	1.60	4501	.38	MM74C92N	1.32		
4038	1.60	4502	1.75	MM74C95N	1.61	MM80C97N	.84
4040	1.50	4503	1.15	MM74C107N	1.89	MM80C98N	.84
4041	1.45	4506	.70	MM74C150N	5.67		
4042	1.25	4507	1.00	MM74C151N	3.80		
4043	1.20	4508	4.00	MM74C154N	5.67		
4044	1.25	4510	1.75	MM74C157N	3.40		
4045	2.50	4511	2.00	MM74C160N	1.71		
4046	1.95	4512	1.50	MM74C161N	1.71		
4047	2.50	4514	4.75	MM74C162N	2.57		
4048	1.00	4516	4.75	MM74C163N	1.71		
4049	.61	4516	1.75	MM74C164N	1.61		
				MM74C165N	1.61		

LINEAR

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LM301AH	.35			LM2900N	.90
LM301AN	.35			LM2901N	2.95
LM302H	.75			LM2902N	3.00
LM306H	2.50			LM2903N	1.60
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LM307N	.35	LM702H	.79	LM2917N	2.00
LM308AH	3.75	LM703LN	.45	LM3046N	1.25
LM308AN	3.00	LM703CH	.45	LM3053N	1.50
LM308H	1.00	LM709CH	.40	LM3064N	1.25
LM308N	1.00	LM710CH	.60	LM3065N	1.00
LM310H	1.15	LM710N	.75	LM3067N	2.60
LM310N	2.00	LM711CH	.39	LM3075N	1.75
LM311D	2.00	LM711CN	.39	LM3089N	3.00
LM311H	.90	LM723CH	.55	LM3146N	2.00
LM311N	.80	LM723CN	.55	LM3302N	2.00
LM311N	.80	LM725CH	2.50	LM3401N	.80
LM312H	2.70	LM725CN	3.00	LM3900N	.49
LM318H	1.50	LM733CH	1.80	LM3905N	.89
LM318N	1.50	LM733CN	1.80	LM3907N	2.60
LM319N	1.25	LM739N	1.19	LM3909N	.89
LM321H	3.00	LM741CH	.35	LM3911N	1.25
LM322N	3.00	LM741CN	.35		
LM324N	1.65	LM741CJ	.39	LM4024N	2.75
LM339AN	3.00	LM741CN	.39	LM4044N	3.00
LM339N	.99	LM747CH	.79	LM4250CH	2.00
LM348N	1.85	LM747CN	.79	LM4250CN	2.00
LM350N	1.00	LM748CH	.39	LM4558N	.75
LM358N	1.00	LM748CN	.39		
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LM375N	3.00	LM1304N	1.19	RCA LINEAR SERIES	
LM377N	2.00	LM1305N	1.40		
LM380N	1.65	LM1307N	.85	CA3013	2.15
LM380N	1.05	LM1310N	2.25	CA3023	2.56
LM381N	1.75	LM1358N	1.00	CA3035	2.48
LM382N	1.75	LM1414N	1.75	CA3039	1.35
LM386H	.85	LM1458H	1.30	CA3046	1.30
LM387AN	.75	LM1458N	.59	CA3059	3.25
LM387N	.95	LM1468N	2.90	CA3060	3.25
LM388N	1.25	LM1488N	1.95	CA3080	.85
LM389N	1.25	LM1489N	1.95		
		LM1496H	.95	CA3081	2.00
NE531T/V	2.00	LM1496N	.95	CA3082	2.00
NE550A	1.20	LM1556N	1.75	CA3083	1.60
NE555V	.39	LM1596J	2.25	CA3086	.85
NE556B	1.25	LM1800N	1.90	CA3089	3.75
NE560B	5.00	LM1808N	2.00	CA3130	1.39
NE562B	5.00	LM1810N	2.00	CA3140	1.25
NE565B	1.50	LM1812N	4.00	CA3401	.49
NE566B	2.00	LM1820N	1.25	CA3600	3.50
NE566T/V	1.75	LM1830N	2.00		
NE567V	1.59	LM1845N	1.75		

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2.0 MHz	5.95
2.097152 MHz	8.50
2.4576 MHz	8.50
2.667 MHz	8.50
3.00 MHz	8.50
3.20 MHz	8.50
3.2768 MHz	8.50
3.579545 MHz	1.25
4.0 MHz	4.95
4.0 MHz	4.95
4.194304 MHz	4.95
4.91520 MHz	4.95

FREQUENCY	price
5.0 MHz	4.95
5.0688 MHz	4.95
5.185 MHz	4.95
5.7143 MHz	4.95
6.00 MHz	4.95
6.144 MHz	4.95
6.40 MHz	4.95
6.5536 MHz	4.95
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flyer
NUMBER 8

It is not very often that there is a journal/newsletter that the Digital Group is able to recommend without some hesitation (and we get them all). However, Dr. Dobb's Journal of Computer Calisthenics & Orthodontia is one pleasant exception. Jim Warren, the editor, has put together **a good** concept and is managing to follow through very well indeed. There is no advertising in the Journal. It is supported solely on subscriptions. That also means that manufacturers have zero leverage over the content of the magazine. The Journal's primary purpose is to place significant software into the public domain and to provide a communications medium for interested hobbyists. The approach is professional and they are growing quickly.

(In case it might appear otherwise to some people, there is no official link whatsoever between the Digital Group and Dr. Dobb's Journal - we've taken our lumps as appropriate just like everyone else when Jim felt they were justified.)

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*** CALIF STANDARD DEDUCTIONS            1000.00
*** CALIF TAXABLE INCOME                20905.00
*** TOTAL CALIF TAX PAID                 1400.00
*** TOTAL CALIF TAX OWED                 1424.55
*** OWE CALIF TAX                          24.55


*** FED TAX % OF INCOME                    21.31
*** CALIF TAX % OF INCOME                  6.50
*** F.I.C.A. % OF INCOME                   4.44
*** TOTAL TAX % OF INCOME                 32.26


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STOP IN LINE 41700
READY
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Crazy Ball with North Star Disc BASIC

By Sy Feierstadt

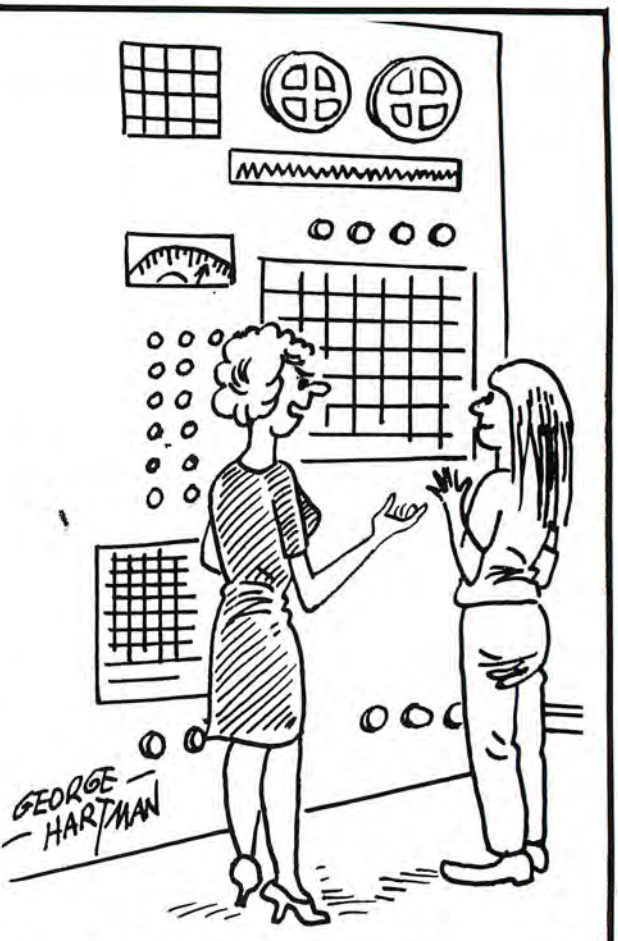
In our August 1977 issue, we published a software program called 'CRAZY BALL' by Elliott Myron. Mr. Myron's program was written in MIT's 8K BASIC using a PolyMorphic VTI interface addressed at 7C00 (HEX). This is a modified version of Mr. Myron's program 'CRAZY BALL' to be used with North Star's Disc BASIC.

The video portion is used with a VDM video driver addressed at CC00 (HEX) which is 52224 decimal. The VDM has no graphics capabilities but this program will allow graphics display. The technique can be used with many graphic games. This also holds true in this modified version.

```
0 REM MICRO-BYTE
1 REM INTERFACE AGE AUGUST 1977
2 REM ORIGINALLY WRITTEN FOR A POLY VTI BOARD
3 REM BY ELLIOTT MYRON
4 REM MODIFIED FOR 'VDM' VIDEO DRIVER USING
5 REM NORTHSTAR DISC BASIC
6 REM MODIFIED BY SY FEIERSTADT
7 REM MICRO BYTE
8 REM P O B 4248
9 REM MIAMI LAKES, FLORIDA  33014  PHONE (305) 822-6810
10!CHR$(11)\V=52224\GOTO990
20INPUT"DO YOU WANT INSTRUCTIONS: ",A$
30IFA$="YES"THEN900
40IFA$="Y"THEN900
50 V=52224\!CHR$(11)\A=160\B=160\C=96\D=46\G=160
60!CHR$(11)
70 INPUT"1=SLOW GAME  2=MEDIUM GAME  3=FAST ",X
80 IF X=1 THEN X=20\IF X=2 THEN X=10\IF X=3 THEN X=8
90 IF X>3 OR X<1 THEN X=8\!CHR$(11)\REM SETUP FIELD
100FORI=1TO63\FILLV+I,A\NEXT
110 FILL V+64,32
120FORI=961TO1023\FILLV+I,B\NEXT
130FORI=65TO897STEP64\FILLV+I,C\NEXT
140 FOR I=127 TO 1023STEP64\FILLV+I,D\NEXT
150REM SETUP PADDLE
160 F=505+V\FILL F,G
170 K=453+V\L=463\F1=1\GOSUB 850
180 T1=T1+1
190 FILL K,L
200REMCHECK PADDLE POSITION
210H=INP(252)
220IF H=49 THEN260\REM PADDLE UP
230IF H=50 THEN300\REM PADDLE DOWN
240REM ANY OTHER KEY WILL FREEZE THE PADDLE
250GOTO350
260 IF EXAM(F-64)<>32 THEN 290\FILL F,32
270F=F-64
280GOTO340
290GOTO350
300 IF EXAM(F+64)<>32 THEN 330\FILL F,32
310F=F+64
320GOTO340
330GOTO350
340 FILL F,G
350REM MOVE BALL
360J=INT(RND(0)*3)
370FORN=1TOJ
380 IFN=J THEN710
390 FOR I=0 TO X\NEXT\IF EXAM(K+F1)<>32 THEN 400\FILL K,32\K=K+F1\GOTO410

400GOTO440
410 FILL K,L
420 NEXT
430GOTO210
440M=EXAM(K+F1)
450IFM=DTHEN690\REM OUT OF BOUNDS
460IFM=GTHEN660\REM HIT PADDLE
470IFM=CTHEN690\REMHIT LEFT SIDE
480GOTO410
490!CHR$(11)
500 !"TOTAL GAMES ",T1,"  BALLS RETURNED ",T
510 FOR I=1 TO1000\NEXT
520 IF T1=15 THEN 540
530 GOTO90
540 IF T<5 THEN 550 ELSE 560
550 !"I HAVE SEEN BETTER"\GOTO 650
560 IF T<10 THEN 570 ELSE 580
570 !"OH WELL, MAYBE YOU WILL DO BETTER NEXT TIME"\GOTO650
580 IF T<20 THEN 590 ELSE 600
590 !"AT LEAST YOU ARE IMPROVING"\GOTO650
600 IF T<30 THEN 610 ELSE 620
610 !"HMMM, YOU MUST BE CHEATING"
620 IF T>=30 THEN 630
630 !"WELL, IT LOOKS LIKE YOU BEAT THE COMPUTER...!"
640 GOTO 650
650GOTO1290
660 F1=-1\GOSUB 850
670T=T+1
680GOTO390
690F1=1\GOSUB850
700GOTO210
710 IF F2=0 THEN 390
720IFF2=-1THENR00\REM DOWN
730REM UP
740REM
750REM
760 IF EXAM(K-64+F1)=32 THEN 780
770F2=-1\GOTO390
780 FILL K,32
790 K=K-64+F1\GOTO390
800REM
810REM
820 IF EXAM(K+64+F1)=32 THEN 840
830F2=1\GOTO390
840 FILL K,32\K=K+64+F1\GOTO390
850REM GET RANDOM DIRECTION FOR Y AXIS (F2)
860F3=F2
870 F2=INT(RND(0)+.5)-INT(2*RND(0)+.5)
880IFF2=F3THEN870
890RETURN
900!\!"MOVE THE PADDLE UP OR DOWN TO HIT THE BALL..."
910!"PRESS THE FOLLOWING KEYS: "
920!TAB(10),"KEY #1. . . . . UP"
930!TAB(10),"KEY #2. . . . . DOWN"
940!TAB(10),"SPACE KEY . . . . FREEZE"
950!\!"THE OBJECT IS TO GET AS MANY POINTS AS POSSIBLE..."
960!"YOU GET ONE POINT EVERYTIME THE BALL HITS THE PADDLE..."
970INPUT"ARE YOU READY!...? ",A$\IFA$="YES"THEN50\IFA$="Y"THEN50
980GOTO970
990FORI=1TO51\READA\READA2
1000FORJ=A1 TO A2\FILLV+J,160\NEXTJ
1010NEXTI
1020J=0\GOTO1150
1030!CHR$(11)\GOTO20
1040DATA0,5,8,13,19,21,27,35,38,40,44,46
1050DATA64,65,72,73,76,77,95,98,103,105,107,109
1060DATA2,83,85,86
1070DATA128,129,136,140,145,151,156,159,169,171
1080DATA192,197,200,201,204,205,208,209
1090DATA215,216,219,227,233,235
1100DATA459,466,474,476,483,484,494,495
1110DATA523,524,530,531,537,538,540,541,547,548,558,559
1120DATA587,593,600,606,611,612,622,623
1130DATA651,652,658,659,663,664,670,671,675,676,686,687
1140DATA715,722,726,727,735,736,739,742,750,758
1150 FOR Z=1TO5
1160FORI=320TO383STEP4
1170FILLV+I,160
1180FILLV+383+383-I,160
1190 FILL V+I,32
1200FILLV+383+383-1,32
1210FILLV+I+66,160
1220FILLV+383+383-1-66,160
1230FILLV+I+66,32
1240FILLV+383+383-1-66,32
1250NEXTI
1260 IF J>1 THEN 1270
1270 NEXT
1280FORJ=1TO3000\NEXTJ\GOTO1030
1290FOR Z=1TO2000\NEXT
1300 !CHR$(11)
1310!\!TAB(15),"F I N A L  S C O R E S"
1320!\!TAB(10),"GAMES PLAYED ",T1,"  BALLS RETURNED ",T
1330!
1340!TAB(5),"WOULD YOU LIKE ANOTHER TRY AT IT...",
1350INPUT A$
1360 IF A$="YES"THEN60
1370 IF A$="Y" THEN 60
1380 END
READY
```

"Dickie says that if we don't let HIM re-program the train he won't play with us anymore."



'It does the work of seven men and I operate it!"

"The computer must know it's being replaced — this is its last will and testament!"

"When'll I be eligible to come back and try out for the job again?"

WIR SUCHEN FACHBRIEFE

LLAMAMOS PARA MONAGRAFIAS

APPELLE POUR MONOGRAPHES

CALL FOR PAPERS

The February issue will feature an International Special, the first in an ongoing series. INTERFACE AGE wants to inform its readers on microcomputing activity the world over. We have readers in many foreign countries and invite authors from outside North America to submit manuscripts.

Readers from Britain, Europe, Eastern Europe, Japan, South Africa, Australia, Latin America: We are seeking articles on your experience in microcomputing for home and professional use. Hobbyists and professional small system users are invited to share their problems and solutions with our readers.

For those of you who can read English, but have not yet tried writing, make an attempt. Outline your article in the same manner as you would in your native tongue. Keep your sentences short; use graphics and photos whenever possible. Type your text neatly double-spaced on letter-size paper. Do not be concerned about your language inadequacies. We'll polish your text before publication. Honoraria range from $15 to $50 per printed page. Payment shall be remitted in the method of your choice.

FIFO FLEA MARKET

FOR SALE: Microdata minicomputer 810 with 16K core memory and Mohawk card reader with interfaces, manuals. Cost over $8000, asking $1300. F-Co, 1506 Sandcastle Dr., Corona del Mar, CA 92625, (714) 644-6031 evenings.

FOR SALE: Sphere 310A microprocessor. As is. Includes: M6800 CPU, cassette interface, video interface, ASCII keyboard, 4K memory, EPROM monitor (editor, assembler, and debugger), and, power supply. First reasonable offer takes it. Jerry Katcher, 303 Sample Bridge Rd., Mechanicsburg, PA 17055.

FOR SALE: 8K-8080A system, 6 parallel I/O ports (add 2 chips for 3 more PIO and 1 serial), 3K PROM brd (w/o 2708 PROM), 2-4K 450nsec low power static RAM, TVT-II terminal with cursor control board, Uart board, 2K RAM board, Hall effect ASCII keyboard, HITS audio cassette interface, (sockets for all chips). All boards new, unused, most assembled, 5 amp power supply, edge connectors, card guides, case, documentation, two-60 chip wire wrap protoboards with 96 w.w. sockets. $695. Write for more info, David Krivoshik, 18 Newcomb, Elizabeth, NJ 07202.

FOR SALE: TVT-3 terminal, unused. $95 or best offer takes. Also ASCII keyboard in perfect condition with MOS circuitry, optional parity, etc. for $20. David Tucker, 23681 Marlow, Oak Park, MI 48237. Or call after 4:00 (313) 967-3130.

DISK FILE Management Programs: Minimum memory requirements. No scratchpads, file to file merge, or wasted space. Fast binary retrieval on alphanumeric linked keys. Entry and update programs in BASIC, easily converted to any language. Optimized algorithms, ample remarks. Send $10 for source listings ($10.65 Calif. res.) to TEL-ADS, 7364 San Ramon Rd., Dublin, CA 94566.

TELEPRINTERS FOR SALE: Model 15 (Baudot) with table, $65.00; Model 28 ASR's, KSR's, RO's (write); Model 33ASR with modem, $675.00. Some Model 35 (ASCII) equipment available. Tape punches and readers. Parts and supplies (tape, paper, ribbons). Model 33ASR wiring diagram packet, $5.75; Model 33 copyholders, $14.00; Model 33 readers and parts, write. Send SASE for list. Lawrence R. Pfleger, 2141 N. 52nd St., Milwaukee, WI 53208.

FOR SALE: IMSAI 4K EPROM board with EPROMs. Never used, $350. Associated Electronics PROM burner (burns 1702 and 8702 EPROMs) with power supply, $260. J. Williams, 2415 Ansdel Ct., Reston, VA 22091.

WANTED: Used Qantel computing equipment: CPUs, peripherals, PC cards, manuals. Ron Tipton, Route 7, Fayetteville, AR 72701, (501) 643-2191

FOR SALE: Altair's Centronics 701 line printer. Complete with controller card. Can be used in S100 bus. 3 months old. Sells for $2375, will sell for $1750. Scott Jacobs, (312) 827-3198 or (312) 638-0446.

SOFTWARE Exchange: North Star Disc Media. Let's swap. Send SASE to HBR, Box AF, Woodbridge, CT 06525.

FOR SALE: Sanyo VM4155 solid state video monitor, new. $200. J. Williams, 2415 Ansdel Ct., Reston, VA 22091.

FOR SALE: S100 connectors. Gold 3-lev WW, .025 pins spaced .125, .250 between rows, ears. Fits IMSAI motherboards. Solder near conn. on S-100 + 5 & Grn — still space for 2 wraps/post. All other pins have NO solder, but may be WW'd. Pins straight. $3.25 ea., 50 + $3.00. Card guides: 25¢/pr. Add $2/order ship. Mark La Casse, 3 Ames St. (MIT); Cambridge, Massachusetts 02139.

FOR SALE: Professional assembly! PR-40 alphanumeric printer. Works beautifully! New condition, $200. 63 key alphanumeric keyboard with 9 LED status indicators. Also new, complete with power supply, $40. Both for $230. Call Tom P. Chen, 822 Valley Crest St., La Canada, CA 91011, 790-7702.

FOR SALE: Altair 8800A, 24K static, Expander board, 2 SIO, 88 ACR, ASR-33 w/auto TD, iCOM microfloppy, disc BASIC, assembler, editor, monitor. All manuals. All up and running. Best offer. Harris G. Bruch, P.O. Box 1155, Pittsburgh, NY 12901, (518) 561-1532/561-4680.

FOR SALE: 1 Digideck Model 60 digital recorder with motor control and dual read/write amplifiers. New in original packing with manual. $100. R. Carideo, 32 Marlboro St., Malden, MA 02148.

FOR SALE: Altair 8800A computer, assembled and tested. Hardly used, excellent condition. Includes 1024 bytes statis memory and manuals. $625 or best offer. Frank Guidi, 11097 Ave., 424, Dinuba, CA 92618, (209) 591-3763.

WANTED: Speech Lab kit or assembled board and documentation or manuals by themselves. State condition and price. For Sale: PROM programming from Binary or Hex paper tape: 1702A ($4), 2708 ($8). From Hex or Octal listing: 1702A ($5), 2708 ($16). You supply the PROM. I have a few 1702A PROMs available at $6 each. Quantity discounts on programming. 48 hour turnaround. H.S. Corbin, 11704 Ibsen Dr., Rockville, MD 20852. (301) 881-7571.

FOR SALE: 5.4 megabyte disk packs. Beautiful shape, guaranteed to initialize. Fit IBM 2311 or Honeywell 172B drives (2.7 megabyte on IBM). Original cost up to $400. Sell for $5 plus $2 shipping. Harry Handley, 437 Selkirk Dr., Winter Park, FL 32792, (305) 645-1765

FOR SALE: Two PTC 16KRA memory boards (16K bytes) $350 each. Quantronics MM8B memory board (8K bytes) $150. All boards factory assembled and tested and brand new. Lorin S. Mohler, 219 N. Sweetwater St., Anaheim, CA 92806, (714) 998-5831 after 5 p.m.

FOR SALE: ASR 33 teletype including 4 rolls of white bond paper. Excellent condition. $850.00. Steve Faber, bus. (213) 659-9440. Home (213) 851-3761.

FOR SALE: All MITS, all work. (3) 4K dynamic boards $100 each, (3) 4K synchronous boards $125 each, 1K static board $50. SIO-C setup for TTy, $75. Mother board expansion $10 each. Poly-Morphic 64 char. video board $125. John R. DeHart, 9303 Town Park Dr., Houston, TX 77036, (713) 981-4267.

FOR SALE: Most of the memory and CPU parts, blueprints and description for the IMP-16 system by Hal Chamberlain, as described in The Computer Hobbyist. Send SASE for list and prices. Larry Neville, Rt. 2, Box 65E, Talbott, TN 37877.

WANTED: Diablo Hytype II in good condition. Prefer 1620 terminal, but will take printer only if all self-contained in cabinet. Neil Ferguson, 116 Woodland Cir., Arlington, TX 76013. (817) 265-9054.

FOR SALE: Imsai 8080, with 22 slot motherboard, MIO board, VTI 64 video interface, 8K of RAM, keyboard and paper tape, all assembled and running. Call (703) 992-4903. John Cummins, Rte. 2, Box 330, Troutville, VA 24175.

FOR SALE: (2) 8K Solid State Music memory boards, 500 nsec., static, plus spare ICs, all for $380. Color video recorder plus video camera and zoom-lens plus extra video cassettes, all for $400. Larry Wright, P.O. Box 7576, Menlo Park, CA 94025, (415) 854-5678.

FOR SALE: Complete M6800-based Wintek system. Includes 6800 CPU, 16K static memory, 1K ROM monitor, Wintek BRB video terminal (80x24), SWTPC AC-30 cassette interface w/2 cassette players, PR-40 printer, and Centronics 306 serial printer. Make offer for any or all. Call or write Scott Daily, Box 741, Lafayette, IN 47901, (317) 742-1417.

Vectored from Page 152

```
1270 C1$(4)="FOREIGN RESOURCES ARE "
1275 C1$(5)="RECENT TECHNOLOGICAL ADVANCES ARE "
1280 C1$(6)="OUR INNOVATIVE APPROACH IS "
1285 C1$(7)="OUR RESEARCH WORK IS "
1290 C1$(8)="COMPANY POLICY IS "
1295 C1$(9)="UPPER MANAGEMENT IS "
1300 C1$(10)="NEAR TERM DEVELOPMENTS ARE "
1301 REM D1$ SUBROUTINE
1305 D1$(1)="I-CAM "
1310 D1$(2)="CAM-I-CAPP "
1315 D1$(3)="U-CAM "
1320 D1$(4)="V-CAM "
1325 D1$(5)="RDM "
1330 D1$(6)="CADAM "
1335 D1$(7)="R2-D2 "
1340 D1$(8)="CP-30 "
1345 D1$(9)="ROBOTICS "
1350 D1$(10)="NAKED MEMORY "
1351 REM D2$ SUBROUTINE
1355 D2$(1)="PATTERNS "
1360 D2$(2)="SOLUTIONS "
1365 D2$(3)="VARIABLES "
1370 D2$(4)="APPROACHES "
1375 D2$(5)="METHODOLOGIES "
1380 D2$(6)="ENGINEERING AIDS "
1385 D2$(7)="OPTIONS "
1390 D2$(8)="ARGUMENTS "
1395 D2$(9)="CONCEPTS "
1400 D2$(10)="TECHNOLOGIES "
1401 B9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1402 F9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1403 G9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1404 H9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1405 J9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1406 K9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1407 L9$=B5$(FNA)+B6$(FNB)+B7$(FNC)
1408 Z$=". "
1409 A6$="BUT "
1410 REM SENTENCE #1
1411 N$=" "
1412 AA$=A1$(FNA)+B9$+A2$(FNA)+A3$(FNA)+A6$+F9$+A4$(FNA)+G9$+Z$
1413 REM SENTENCE #2
1414 BB$=K$+N$+B1$(FNB)+B3$(FNB)+B4$(FNB)+Z$
1415 REM SENTENCE #3
1416 C2$="DUE TO A "
1417 CC$=C1$(FNC)+A3$(FNC)+C2$+H9$+Z$
1418 REM SENTENCE # 4
1419 D3$="ARE "
1420 DD$=D1$(FNA)+D2$(FNA)+D3$+J9$+Z$
1421 REM SENTENCE # 5
1422 E1$="BECAUSE OF "
1423 E2$="A "
1424 EE$=D1$(FNB)+A4$(FNB)+E2$+B3$(FNC)+B4$(FNA)+E1$+K9$+Z$
1425 Y1$=R$(FND):Y2$=R$(FNE):Y3$=R$(FNF)
1427 IF Y1$<>Y2$ THEN 1428 ELSE 600
1428 IF Y1$<>Y3$ THEN 1429 ELSE 600
1429 IF Y2$<>Y3$ THEN 1433 ELSE 600
1433 PRINT Y1$;Y2$;Y3$
1434 PRINT
1435 NEXT I
1440 PRINT
1450 PRINT
1455 PRINT
1460 PRINT "THE ABOVE IS THE REPORT YOU REQUESTED BE COMPILED"
1465 PRINT "FOR ";K$
1475 PRINT
1480 PRINT "DO YOU NEED ANY MORE REPORTS?"
1485 PRINT "TYPE-YES, OTHERWISE TYPE-OVER"
1490 INPUT M$
1495 IF M$="YES" THEN GOTO 200
1500 IF M$="OVER" THEN GOTO 1530
1505 GOTO 1490
1530 PRINT"HOPE YOU WERE SATISFIED."
1535 PRINT "      GOODBYE"
1540 END
OK
```

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The authors of this issue would like to know your feelings as to which article you consider the best. You may cast your vote on *only* one article. Select the best article and circle the corresponding number on the reader service card.

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394 Turning Toward MECA *by Carl Denver Warren II*

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396 Computerese Speech Writer *by Ashok Nagrani*

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399 The Tax Man *by Gary O. Young*

400 Crazy Ball for North Star BASIC *by Sy Feierstadt*

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301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400

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E. ☐ Student
F. ☐ Hobbyist
G. ☐ Other _____

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3. I Need This Information For
A. ☐ Immediate Purchase
B. ☐ Purchase 30-60 Days
C. ☐ Comparisons
D. ☐ Literature Library
E. ☐ Other _____

4. My Interest Emphasis Is
A. ☐ Hardware
B. ☐ Firmware
C. ☐ Software
D. ☐ Other _____

5. My Application Is
A. ☐ Hobby Only
B. ☐ Business Only
C. ☐ Hobby & Business
D. ☐ Instruction Purposes
E. ☐ Research
F. ☐ Design & Development
G. ☐ Other _____

6. My *Primary* Source Of "State-of-the-Art" Information Comes From:
A. ☐ Magazines
B. ☐ Exhibits & Conventions
C. ☐ Club Meetings
D. ☐ Direct Mail From Manufacturers.
E. ☐ Other _____

7. I prefer To Buy
A. ☐ Directly From Manufacturers
B. ☐ Local Computer Retailer (Store)
C. ☐ Mail Order
D. ☐ Club Group Purchases
E. ☐ Other _____

8. I Look To *INTERFACE AGE* First For
A. ☐ New Product Information
B. ☐ Software Information
C. ☐ Tutorials
D. ☐ Hardware Articles
E. ☐ Product Advertising
F. ☐ Remarks _____

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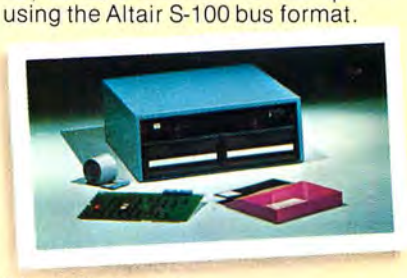

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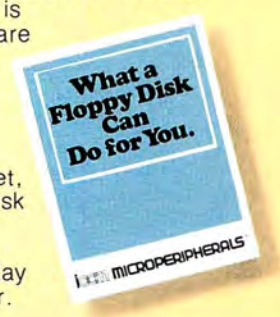

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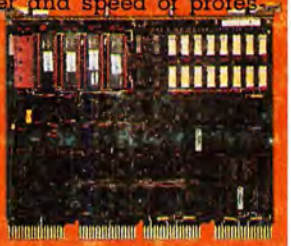

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